Abstract No. 1

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Title: RHD POSITIVE VARIANTS IN MOROCCAN BLOOD DONORS SEROLOGICALLY D NEGATIVE: IDENTIFICATION OF 6 NOVEL INTRONIC MUTATIONS

Text:

Background: Blood group genotyping is increasingly utilized in transfusion and obstetric medicine. In Caucasians, the presence of antigen D is predicted, if two or more RHD specific polymorphism are detected. In the presence of non-functional RHD, this prediction must fail giving false positive results. Excluding RHD pseudogene (RHDψ) and CdeS frequent in individuals of African origin, most of these variants have not been determined in Morocco.

Methods: Among a total of 544 D negative blood donors, 65 blood samples RhC and/or RhE positive were tested by serologic tests. Samples serologically D negative were screened by PCR using sequence specific priming, multiplex PCR and next generation sequencing. For novel mutations, the Alamut software was used to predict their possible effect on splicing.

Results: Seventeen samples (26.1%) previously documented as RhD negative had been missed by routine serology. The complete deletion of the RHD gene is observed in 81.2% of blood donors serologically D negative C and/or E positive. Sequencing reveals 9/48 RHD positive samples. Five new variants were detected, each one caused by more than 2 intronic mutations. Overall, 6 novel mutations were characterized far from conserved splice sites. The bioinformatics results suggest that 3 mutations affect splicing. Two samples were CdeS allele and 2 variants were not confirmed.

Conclusion: This study is the first to describe RHD variants caused by intronic variations far from the splice sites. Further investigations in RHD gene in Maghrebian population will allow improving RHD genotyping strategy.
Abstract No. 4

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Title:
PATHOGEN REDUCTION OF PLATELET CONCENTRATES WITH A NOVEL INTERCEPT TRIPLE STORAGE SET

Text:
Background: The INTERCEPT Blood System for platelets (Cerus) was developed to prevent transfusion-transmitted infections by inactivating pathogens in platelet concentrates (PC). Pathogen inactivation is achieved by a photochemical treatment process utilizing amotosalen (S-59) and UVA. A novel triple-storage set (TS) has been designed to treat single, double or triple donations in a plasma/PAS suspension (up to 12x10^11 platelets in 650 mL).

AIMS: The objective of this study was to evaluate production parameters of PC processed using this novel set (TS) compared to a set routinely used with single storage container (LV).

Methods: This study used a pool-and-split design with buffy coat (BC) platelet concentrates separated on the TACSI system (Terumo BCT) or apheresis platelet (AP) collected using the Amicus system (Fresenius). 3 BC-PC or 2 AP were pooled and were split back into 2/3 and 1/3 volume units compatible with respectively TS (Test, n = 12) and LV (Control, n = 12) INTERCEPT sets. Test units were connected to a TS set (15 mL of S-59 6mM), UVA illuminated and transferred to a double Compound Adsorption Device (CAD) for agitated storage for 4 hours and finally split into 3 PC. Control units received the same treatment using a LV set (17.5 mL of S-59 3mM) and 6 hours single CAD treatment. Samples were drawn before and after INTERCEPT treatment.

Results: Illumination times (mm:ss) were at 08:13 ± 00:20 for Test units (525 to 648 mL) and 05:16 ± 00:22 for Control units (312 to 340 mL). Volume losses (incl. S-59) were at 58 ± 4 mL with Test units and 37 ± 7 mL with Control units. These volumes were associated with platelet losses respectively at 0.65 ± 0.46 E+11 and 0.46 ± 0.30 E+11. Residual S-59 was < 0.5 µM in all Control and Test units. Expression of excess of air, loading into illuminators or agitators were more difficult in Test than Control units. Test sets are cumbersome.

Conclusion: TS sets were found appropriate to treat multiple dose PC for pathogens reduction. For equivalent throughput, despite using a double CAD, volume and platelet losses were lower with one TS than two LV sets. TS set has a 2 hours shorter CAD time than LV set with acceptable residual S-59.

Abstract No. 5

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Title:
IMPROVED HBV DONOR SCREENING: SHOULD CURRENT HEPATITIS B RE-ENTRY PROCEDURE BE REASSESSED?

Text:
Nucleic acid testing (NAT) for Hepatitis B (HBV) was introduced at the Zurich Blood Transfusion Service SRC in April 2008 using the TaqScreen MPX test on the platform cobas s201 (Roche Diagnostics). On December 1st, 2015 we implemented the new MPX test on the system cobas 6800 (Roche Diagnostics). Using the new system, individual donation testing (ID-NAT) is possible instead of mini-pool testing (MP-NAT, n = 6) with the previous platform. Lower Limit of Detection (LOD) for HBV combined with ID-NAT by cobas 6800 increased screening yield of HBV positive blood donations.

MP-NAT of 662,899 blood donations revealed 73 HBV DNA positive donations which were also positive for HBsAg and 4 HBV NAT only positive donations (HBV only), corresponding to a frequency of HBVonly of 1:165,725. Since implementing cobas 6800, in total 38,658 donations yielded 16 HBV positive donations (8x HBV-NAT+/HBsAg+, 8x HBV-NAT+/HBsAg-), giving a frequency of HBVonly of 1:4,832. Extended serology testing of HBVonly revealed exclusively occult HBV infections (OBI, anti-HBc+/HBsAg-). Since all donations were given by repeat donors, look-back testing/procedures were initiated. Archive samples of 7/8 OBI donors were available for testing and 5/7 donors delivered HBV positive archive samples by ID-NAT (overall 6/28 HBV positive archive samples). Detailed results will be presented.

Conclusion: Since transfusion transmission of HBV by OBI donations cannot be excluded, we propose to reassess current HBV re-entry algorithm in Switzerland.
Abstract No. 6

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Title:  
UNUSUAL BIG PH DROP IN PATHOGEN REDUCED PLATELET CONCENTRATES OF SEVERAL CONSECUTIVE DONATIONS FROM THE SAME DONOR

Text:  
Background: Platelets are metabolically active. Due to the isolated environment in a platelet concentrate (PC), pH value drops during storage time. This decrease is more intense in pathogen reduced (amotosalen/UVA) platelet concentrates (pPC) than in native, non-treated platelet concentrates (nPC) [Picker, Transfusion, 2004; Moog, JCA, 2004]. Pathogen reduction in PCs is mandatory in Switzerland, and to date, there is only one approved method (Cerus Intercept, amotosalen/UVA). According to the applicable regulations in quality control, the pH value of at least one percent of all produced PCs has to be measured at or after the end of maximal storage time of 7 days (acceptance limit pH > 6.4).

Case presentation: We report about three consecutive apheresis donations from the same donor (donation 1: 29.12.2014, donation 2: 09.02.2015, donation 3: 23.03.2015). Two units of pPC were produced from each donation of the donations 1 and 2. All four units dropped < pH 6.3 on day 8 after donation. Donation 3 was taken solely for research purposes (in consent with the donor). Three products were made from donation 3: one pPC, one nPC and one plasma unit. All three products were stored at 22°C and the nPC and the pPC were kept on the platelet agitator. The pH values of all three products were measured daily except on day 6 after donation. At the end of maximal storage time the pH of the pPC was massively below acceptance limit (day 7: pH 6.1, day 8: pH 6.1), while pH values from nPC and plasma remained above 6.4. Since the introduction of the pathogen reduction procedure in our blood donation service, a shortfall of the pH acceptance limit never occurred except in this mentioned case (total number of pH measurements in PCs until December 2015 was 90). Our donor was healthy, fully suitable for donation and took no medication. There were no known metabolic diseases, platelet pathologies or coagulation disorders. Similar pH measurements in a pPC from his daughter, who is a platelet donor in another blood donation service in Switzerland, showed normal values (pH > 6.57 on days 5 to 8 after donation).

Discussion and Conclusion: Although the reason for these multiple pH drops in pPCs of consecutive donations from the same donor remains unclear, it may be related to the pathogen reduction procedure since pH values of nPC and plasma remained above pH 6.4. Regular pH measurements in pPCs at the end of storage time are essential to identify similar cases and possibly find an explanation for the phenomenon that occurred in the mentioned platelet concentrates during storage.

Abstract No. 7

Authors:  
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Title:  
RETURN RATE OF PREVIOUSLY EXCLUDED ELDERLY DONORS AT THE BLOOD TRANSFUSION SERVICE AARGAU-SOLOTHURN

Text:  
Background: In 2012, the upper age limit for blood donors in Switzerland was increased from 65 to 75 years. According to the national blood donor criteria donors above 65 years have to attend at least four interviews with a donor physician until the age of 75, to evaluate the presence and risk of heart disease with a specific anamnesis. The regional blood transfusion service of Aargau-Solothurn decided in 2012 to increase the upper limit to 70 years only, having instead the personal interview with the donor physician only once; this in consideration to the elderly blood donors saving them from regular mandatory health checks. However, due to persistent shortage of available blood donors, this age limit was increased to 75 years per 01.01. 2016. Donors that were previously excluded at the age of 70 years were contacted in order to be “reactivated”.

Objective: to evaluate the blood donor return in elderly donors of the blood transfusion service of Aargau-Solothurn who were previously excluded due to age restrictions and to evaluate the efficacy of the measures employed.

Methods: unicenter, retrospective, observational study. We invited our already due-to-age-excluded blood donors of the blood-groups A and O, who were not yet 75 years old and who had donated blood between 65 and 70 years by means of a letter to establish contact with our donor physician if they would like to donate blood again. We also did local advertising and a press release in order to let public in general know about the new measure and to increase publicity of this policy change.

Results: in total we invited 170 blood donors and in the following six months 85 donors contacted us. Three donors were excluded at the interview due to heart disease. From the donors who established contact 82 became active blood donors again; this represents 48.2% of blood donor return. Of these 82 donors, 41 (50%) have donated more than once since “reactivation”. None of them have suffered any adverse event since their return. In general we received very positive feedback from our blood donors and the public.
**Conclusions:** We observed a highly relevant rate of donor return rates applying simple and readily available means of donor motivation. We are aware that donor satisfaction is a key point in donor return. Our experience suggests that changes of donor criteria which are aimed at increasing donor availability should be actively communicated to previously excluded donors who are affected by these policy changes.

**Abstract No. 8**

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**Title:**
WHO CONTAMINATED WHOM? A CASE REPORT

**Text:**
A 89 year old male patient suffering from thrombocytopenia received preoperatively 1 unit of platelets (storage time nearly 5 days). During transfusion he experienced increased blood pressure, tachycardia, fever, chills and dyspnea.

A blood culture of the patient and a culture of the empty bag of the platelet concentrate (PC) were performed. In both cultures grew Klebsiella pneumoniae (same antibiotic resistance and sensitivity pattern and DNA similarity of 97.2%).

The PC came from a double platelet apheresis collection. Additionally a bag of plasma was gained. After splitting the PC into two units, Pathogen Inactivation (PI) was performed with the Intercept System (Small Volume Set), using Amotosalen and UVA- Illumination as a photochemically treatment to inhibit DNA replication.

Transfusion of the second PC (day 5 after collection) occured without any reaction. From this empty bag and from the plasma, no bacterial growth was detected.

Investigations of all steps of donation and production did not show any non-conformities and the donor did not get sick after donation.

Several sources of bacterial contamination had to be excluded or considered:
- Contamination of the bag systems and solutions were excluded and the functionality of the illuminator was approved. An insufficient amount of Amotosalen or a leakage after or during PI would have been detected by the staff and was therefore ruled out.
- Contamination during collection with Klebsiella pneumoniae is a major risk of platelet transfusion. Asymptomatic, low concentration donor bacteremia seems to be the underlying etiology. After 6 hours, when PI was done, the bacterial concentration could have been close to the threshold of the effective pathogen reduction process for one but not for the other PC. A donor rectal swab sample revealed growth of a Klebsiella pneumonia strain with a low a similarity of 40 % in comparison to the two strains from the patient and the PC.

In contrast the contamination of the PC could have taken place by retrograde flow from an asymptomatic bacteremia in the patient. In case of state of the art handling during transfusion a contamination against gravitation seems impossible.

However during transport of the residual PC to the microbiology laboratory, the Transfusion Set was still connected to the bag as a possible source of retrograde contamination.

Sealing or clipping the Transfusion Set after transfusion seems mandatory to prevent post-transfusion contamination.

**Abstract No. 9**

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**Title:**
SENSITIVITY OF NAT-TESTING FOR INFECTIOUS DISEASE MARKERS ON THE PANTHER PROCLEIX SYSTEM©

**Text:**
Objective: Since January 2016, national regulations in Switzerland require dual target HIV-NAT testing for homologous blood donations. To meet these requirements, the NAT-testing platform cobas s201© (Roche Diagnostics, Switzerland) at the Blood Transfusion Center Aargau-Solothurn had to be replaced. After thorough evaluation, the Panther Procleix system© (Grifols, Spain) was selected as new NAT-testing platform. We present the results of our on-site validation of NAT testing for HIV-1, HBV, HCV, Parvo B19, HAV, and WNV with regards to sensitivity.

Methods: Standards obtained from the Paul-Ehrlich-Institut, Germany or the NISBC, UK, were tested in triplicate according to the manufacturer’s instructions for HIV-1, HCV and HBV with the Procleix Ultrio Elite© assay, for ParvoB19 and HAV with the Procleix Parvo/HAV© assay, and for WNV with the Procleix WNV assay©. We compared 95%-LODs provided by the manufacturer to our results for each virus tested.

Results: Testing for HIV-1 (95% - LOD: 18 IU/mL), HCV (95% - LOD: 3 IU/mL) and HBV (95% - LOD: 4.3 IU/mL) with the Procleix Ultrio Elite© assay showed sensitivities of 18 IU/mL, 9 IU/mL, and 1 IU/mL, respectively. For HAV (95% - LOD: 1 IU/mL) we found a sensitivity of 1 IU/mL, for ParvoB19 (95% - LOD: 325 IU/mL) we observed a highly relevant rate of donor return rates applying simple and readily available means of donor motivation. We are aware that donor satisfaction is a key point in donor return. Our experience suggests that changes of donor criteria which are aimed at increasing donor availability should be actively communicated to previously excluded donors who are affected by these policy changes.
IU/mL) 172 IU/mL. For WNV (95% - LOD: 13 IU/mL) on-site sensitivity was 10 IU/mL.

Conclusions: 95%-LODs provided by the manufacturer could closely be reproduced with slight variations with regards to HCV, HBV, and ParvoB19. Overall, NAT-testing on the Panther Procleix system© is highly sensitive and ensures compliance with the requirements set forth by the national authorities and plasma fractionator.

Abstract No. 10

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Title: AUTOMATIC WASHING OF THAWED HEMATOPOIETIC PROGENITOR CELL GRAFTS: A PRECLINICAL EVALUATION

Text:

Background and Objectives: Autologous hematopoietic progenitor cell (HPC) is a prerequisite for high-dose chemotherapy in treatment of several hematologic and nonhematologic malignancies. They are usually collected by apheresis and are cryopreserved until infusion. Post-infusion adverse events have been in part related to the dimethyl sulfoxide (DMSO) used as cryoprotectant. We investigated three washing solutions in replacement of hydroxyethyl starch (HES)-based solutions commonly used for processing of HPC and evaluated an automated washing procedure for DMSO removal in thawed HPC grafts.

Materials and Methods: A total of 26 peripheral blood HPC bags cryopreserved with 10% DMSO and intended for disposal were used. The Sepax 2 S-100 (Biosafe SA) was evaluated using a sequential washing procedure. The DMSO was quantified using high performance liquid chromatography. Outcomes were CD34+ cell recovery and viability after washing.

Results: The Ringer-Lactate supplemented or not with albumin 2.5% or 5% presented satisfactory results compared to HES solution in terms of CD34+ cell recovery and viability after washing. However, the apparition of aggregates led us to renounce to these alternative solutions. Using HES solution and a one-bag washing procedure we obtained a post-washing CD34+ cell recovery of 66.9 ± 16.5% that declined to 56.0 ± 13.6% at +24 hours and a viability decreasing from 79.9 ± 7.2% to 68.3 ± 9.0%, respectively. With the sequential washing of three bags we showed a post-washing CD34+ cell recovery of 79.9 ± 9.4% that decreased to 66.5 ± 19.6% at +5 hours and then remained stable onwards. The post-washing cell viability was 66.5 ± 9.3% and decreased to 49.1 ± 4.8 at +24 hours.

Conclusion: The preclinical evaluation of an automated sequential washing procedure for DMSO removal in thawed HPC grafts has proven to be effective and comparable to previously published data. Despite our attempt to find an alternative solution to the HES solution, more efforts should be done on this side.

Abstract No. 11

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Title: HOW TO MEASURE OXIDANT/ANTIOXIDANT STATUS IN ERYTHROCYTES

Text:

Oxidative stress is one major lesion observed in erythrocytes during their cold storage. Erythrocytes stored as erythrocyte concentrates (ECs) in blood bags permeable to gases are constantly challenged by reactive oxygen species (ROS). When antioxidant defenses are insufficient to balance oxidants, oxidative lesions such as proteins carbonylation or lipids peroxidation start to accumulate, leading to irreversible damages that could compromise the efficacy and safety of transfusion. In order to better understand the underlying causes of oxidative stress, different approaches were used to quantify the antioxidant power and oxidative lesions in ECs during their storage.

The total antioxidant power was quantified by electrochemical pseudo-titration of water-soluble antioxidants in ECs and EC supernatants (EDEL technology). In addition, a colorimetric assay based on the reduction of oxidized ABTS (2,2’-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid)) by the antioxidants present in the sample was used and compared to the previous method (Erel, Clinical Biochemistry, 2004). Levels of uric acid, the main extracellular antioxidant in blood, and thought to be involved in the antioxidant power of EC supernatant, were analyzed by label-free mass spectrometry.
The quantity of intracellular reduced and oxidized glutathione (GSH and GSSG respectively), a major intracellular antioxidant in erythrocytes, was determined after derivatization with N-Ethylmaleimide (NEM) and thiol groups were quantified spectrophotometrically using DTNB (5,5'-dithio-bis (2-nitrobenzoic acid)) (Giustarini et al., Nature protocols, 2013). Finally, two fluorescent reporters of lipid peroxidation and intracellular ROS (respectively BODIPY and Dichlorodihydro-fluorescein diacetate (DCFH-DA)) were employed to evaluate the impact of oxidation.

In parallel, an oxidative assay is under development to further analyze effects of oxidants, antioxidants or metabolites on erythrocytes. Erythrocytes will be exposed to oxidation and morphological changes will be assessed by digital holographic microscopy. Antioxidants are added to protect the erythrocytes and potentially rescue changes of morphology.

Together, these approaches enable the characterization of oxidant and antioxidant levels. The understanding and quantification of oxidative storage lesions are necessary before developing new strategies to ensure the security and to improve the efficacy of transfused erythrocytes from day 1 to day 42 in ECs.

Abstract No. 12

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Title: DTT-TREATMENT OF PANEL CELLS FOR ANTIBODY TESTING OF DARATUMUMAB-CONTAINING SERA USING ID-GEL TUBES

Text: Background: Daratumumab (DARA) is a monoclonal antibody for the treatment of multiple myeloma. It binds to CD38 on the surface of plasma cells, which induces apoptosis. As red blood cells (RBC) also carry small amounts of CD38 on their surface, indirect agglutination testing (IAT) of sera from patients treated with DARA leads to panreactive panel results. Therefore, detection of possible alloantibodies is impaired. Since CD38 has a high disulfide content, treatment of RBC with the reducing agent dithiothreitol (DTT) destroys the antigen and prevents binding of DARA [Chapuy et al., Transfusion, 55, June 2015]. Other blood group systems such as Kell and Lutheran are also affected.

The purpose of this study was to test the suitability of the protocol by Chapuy in a routine immunohematologic laboratory, in order to perform the IAT of treated panel cells and patient serum in the ID-gel tube system.

Methods: IAT was carried out with Panocells 16 (Immucor, USA) and ID-DiaPanel Cells (Biorad, Switzerland) in LISS/Coombs ID-gel tubes (Biorad), antigen determination was performed with ID Antigen reagents (Biorad). A 0.2 M DTT solution in PBS (pH 8.0) was used for the 30' DTT treatment, test cells were washed four times after DTT treatment in PBS pH 7.3. Test sera were obtained from patients under DARA treatment.

Results: Antigen typing before and after DTT treatment showed that the most relevant blood group antigens are not affected by DTT. As expected, the Kell and Lutheran antigens (K, k, Kpa, Kpb, Lua, Lub) are destroyed, but can in some cases still be weakly detected. Using the protocol described by Chapuy we demonstrated that binding of DARA is inhibited by DTT. However, we were unable to obtain clearly negative results with DTT-treated panel cells in the ID gel tube system. Prolongation of DTT treatment led to increased haemolysis (mild haemolysis at 60', severe at 90'). The amount of DTT could be increased without any effect up to six volumes (instead of four).

Conclusion: The proposed protocol for the DTT treatment of panel cells for antibody testing of sera of patients treated with DARA failed in the ID gel tube system. Moderate changes in the protocol did not improve the outcome. As a consequence, we will evaluate IAT of DTT-treated cells and serum of patients treated with DARA in test tubes.

Abstract No. 13

Authors: Ch. Engström 1, A. Caesar 2, S. Meyer 1, C. Portmann 1, N. Trost 1, E. Mayer 1, P. Schwind 2, B. M. Frey 1, Ch. Gassner 1

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Title: A NEW GYPB*04(164T>G, PHE55CYS) ALLELE WITH A PHENOTYPIC PARTIAL CHARACTER OF SMALL S

Text: Background: The S and s antigens of the MNSs blood group system are caused by a single SNP at coding nucleotide (nt) 143C>T (Thr48Met) of GYPB. Antigens SD+ and Mit+ result from SNPs at nts 161G>A (Arg54His) and 173C>G (Pro58Arg) respectively and underlie the immunohematological relevance of this area proximal to the trans-membrane region of the protein on the outer RBC surface. In general, new blood group antigens may be dis-
covered by diagnostic antibodies, discrepancies in pheno-/genotyping, or due to responders’ antibodies. 

**Methods:** Human and monoclonal anti-s typing reagents were applied (Medion Grifols Diagnostics, Duedingen, CH; BioRad, Cressier, CH; Merck-Millipore, Darmstadt, DE) using gel-card, in tube and lateral flow-card assays. Genotyping (MNSs, Inno-Train, Kronberg, DE) and sequencing were performed (Meyer S. et al Br J Haematol. 2016). Trans-membrane helix location was predicted using HMMPHOS, PHOBIUS, TAMPRED, disulphide-bonds using DiANNA, and N-glycosylation using NetOGlyc.

**Results:** Initial phenotyping discrepancies were observed using human anti-s (gel-card) and monoclonal anti-s (in tube) in two unrelated blood donors (Table 1). Samples were heterozygous for GYPB*03/04 (S/s) and both GYPB*04 (s) exons 4 showed the same new mutant allele GYPB*04(164T>G, Phe55Cys). mOAB clones P3Y326 Bn5 used in tube and P3BER in lateral flow assays, delivered reliable positive reactions for this new s, whereas mOAB P3YAN3 failed to detect it. Software did not predict a change in the trans-membrane helix, nor disulphide-bonds. Still, changes in N-glycosylation of the mutated protein were assessed.

**Conclusion:** We describe a partial s. Anti-s was not detected in either donor. Potentially, family analysis could deliver this pre-requisite for considering GYPB*04 (164T>G, Phe55Cys) as a true new MNSs antigen. Still, partial character of the new s and the location of the mutation in a highly antigenetically relevant part of the peptide are of significance.

**Abstract No. 14**

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**Title:**
MALDI-TOF MS GENOTYPING OF 37,234 SWISS PROVES TWO NEW LUTHERAN ALLELES, BOTH POSITIVE FOR AUB

**Text:**
**Background:** The Basal Cell Adhesion Molecule (BCAM) gene, encodes all Lutheran blood group antigens as exemplified by the antithetic Lua/b, LU8/14, Aua/b antigens and the high-prevalence antigen LU13. The antigens are encoded at certain genetic locations of the gene, and by either one of the two specific nucleotides, defining the respective SNPs. In theory, and looking at the 4 exemplary SNPs, 16 different combinatorial haplotypes were to be expected. However, only 5 of them are currently reported and accepted by the ISBT terminology committee.

**Aim of the project:** LU genotyping by MALDI-TOF MS based SNP-detection delivered interesting new evidences with respect to the genetic polymorphism of the Lutheran blood group system in Swiss Caucasians.

**Methods:** Genotyping relied on SNP-detection at coding nucleotides 230 (G/A), 611 (T/A), and 1615 for LU*01/02, LU*02/02.14 and LU*02/02.19, on 37,234 Swiss blood donors, respectively. For LU13, detection of SNP at coding nucleotide 1340 (C/T) was tested using PCR-SSP on 336 individuals with selected genotypes.

**Results:** Among the 37,234 Swiss donors investigated, LU*01, LU*02, LU*02.14 and LU*02.19 alleles were observed, in all homozygous and heterozygous combinations. However, there were also 6 Lu (a+b-) subjects and 1 Lu (a-b+) donor all typed as Au (a-b+), indicating homozygous presence of two theoretically expectable LU haplotypes, proving them as new LU alleles. Both new alleles were unambiguously identified in a variety of heterozygous genotypes. Testing 336 genotypically selected DNAs for LU*02-13, positive signals were neither encountered in 42 Lu (a+b-), nor among 132 Au (a-b+), but in 16 of 96 Lu (a-b+), Au (a+b-) homozygotes. Applying LU*02.-13 PCR-SSP to all other genotypes of the 336 sample group confirmed this finding. Allele frequencies were calculated (Figure 1).

**Results:** Among the 37,234 Swiss donors investigated, LU*01, LU*02, LU*02.14 and LU*02.19 alleles were observed, in all homozygous and heterozygous combinations. However, there were also 6 Lu (a+b-) subjects and 1 Lu (a-b+) donor all typed as Au (a-b+), indicating homozygous presence of two theoretically expectable LU haplotypes, proving them as new LU alleles. Both new alleles were unambiguously identified in a variety of heterozygous genotypes. Testing 336 genotypically selected DNAs for LU*02-13, positive signals were neither encountered in 42 Lu (a+b-), nor among 132 Au (a-b+), but in 16 of 96 Lu (a-b+), Au (a+b-) homozygotes. Applying LU*02.-13 PCR-SSP to all other genotypes of the 336 sample group confirmed this finding. Allele frequencies were calculated (Figure 1).

**Summary:** The MALDI-TOF MS project not only identified 42 Lu(a+b-) and 7 Lu:-8,14 homozygous blood do-
nors, but also delivered new genetic insights into the Lutheran blood group system. The existence of LU alleles, e.g. LU*01.19 and LU*02.19 with simultaneous genetic positivity for LU14 is new. LU*-13 may be expected homozygously once among 371 Swiss individuals.

Abstract No. 15

Authors: N. Heim 1, S. Heer 1, R. Seidlitz 1, Th. Schulzki 1, R. Henschler 1

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Title: SURVEILLANCE OF PATHOGEN-INACTIVATED PLATELET CONCENTRATES TRANSFUSED TO ONCOLOGY AND TRAUMA/SEPSIS PATIENTS

Text:
To control the quality of our platelet concentrates (PCs), we routinely deliver together with the PCs an efficiency evaluation form to the physicians or transfusion nurse, demanding to be returned with filled-in pre- and posttransfusion platelet counts, patients’ age, weight and height. Before release of PCs, the platelet count of all our PCs is routinely determined,

Here we evaluated a total of 98 PLT transfusions (68 Apheresis-PCs and 30 buffy coat derived pool-PCs) to survey the clinical efficacy of our PC production. PCs transfused contained a mean 3.33 ± 0.38 x 10E11 platelets/unit; upper limit 4.67; lower limit 2.48 x 10E11 platelets/unit.

Before evaluation, all patient data were anonymized. Reports were sorted for departments of Oncology and Trauma/Sepsis. CCIs were calculated according to Delaflor-Weiss E, Mintz PD, Transfus Med Rev 2000;14:180-96.

We found that in 94/98 cases, absolute platelet counts increased post PLT transfusion; whereas they remained constant in 2/98 and slightly decreased in 2/98 patients. In 67 cases, CCI (1 hour) could be calculated, and 27 cases, CCI (24 hours). Mean CCI (1 hour) was 10437, the mean CCI (24 hours) was 4078. Body weight and/or height were missing for 7 patients, precluding evaluation of CCIs. A high correlation (r2 = 0.82) was observed between number of platelets in blood at the time of transfusion and increase after PC transfusion when analysing the entire group. No correlation was seen between the platelet dose given and any CCI.

In conclusion, the clinical efficacy of PCs could be assessed in a Kantonsspital. An increase in circulating platelet counts could be demonstrated in 96% of platelet transfusions. Thus, we are able to routinely supervise the quality of our PCs using transfusion success.

Abstract No. 16

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Title: PLATELET-DERIVED EXTRACELLULAR VESICLES IN PLATELET CONCENTRATES

Text:
Background: Platelet-derived extracellular vesicles (PL-EVs) are present in platelepheresis concentrates (PCs) and may influence the quality of PCs. Routine quantification of PL-EVs may be useful in the quality control (QC) of PCs.

Aims of two studies were to establish and validate a QC analysis protocol and to apply this protocol in a multicenter study for PL-EV quantification using standard flow cytometers.

Methods: In one center, the QC protocol for PCs (n = 42) was validated including PL-EV analysis and functional platelet (PLT) capacity (CD62P in response to TRAP-6 activation) by flow cytometry (FCM). A hematology analyzer was applied to the determine PLT counts. All in vitro measurements were carried out on day 0 and on day 5. In the following multicenter study, 86 PCs were investigated in five blood transfusion centers (A - E) on days 0 and 5. Centers used different instruments: Trima (n = 56) and/or Amicus (n = 30). PCs were prepared using standard methods (sd-PCs; n = 73; A - D) or with pathogen inactivation (PI) (PI-PCs; n = 13; E). PLT count, PLT-capacity and PL-EVs were analyzed with the standardized QC protocol1. Results: Externalization of CD62P, indicative
for intact PLT-capacity, significantly decreased during PLT senescence in all 86 PCs (p < 0.001), and PL-EVs increased in 74 PCs (A, C - E; p < 0.001). During storage, PLT count was stable in 58 PCs (A - C, D). In contrast, 12 PCs (B) showed a decrease in PLT count and PL-EVs. Certain donor parameters (e.g., cholesterol, immature platelet fraction) were associated with lower PL-EVs. Longer apheresis time resulted in PL-EV increase. In Trima-produced PCs, PL-EVs were significantly lower (D) and PLT-capacity was superior to PCs prepared with Amicus (A, D). In Pl-PCs, PL-EVs were 10-fold lower compared to sd-PCs, but similar QC-trends during storage (PL-EV increase, loss of PLT-capacity) were demonstrated for both PC-groups.

Conclusion: Measurements of PL-EVs are highly recommended for regular QC of PCs as plausibility check of PLT viability and activation. PL-EV analysis in a QC-program of PCs was successfully performed with results comparable among the different centers. PLT-capacity and PLT-vesiculation were primarily affected by preparation techniques.

Abstract No. 18

Authors:
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Title:
ALLOIMMUNIZATION AGAINST D AND OTHER RHESUS ANTIGENS AFTER PLATELET TRANSFUSION

Text:
Background: Platelet concentrates (PC) contain a small quantity of red blood cells (RBC), being considerably higher in pooled platelet concentrates prepared from whole blood collections (BC-PC) than in PC obtained from apheresis devices (AP-PC). Frequencies of D alloimmunization after transfusing BC-PC are reported to be up to 18.7%. Therefore D matching is currently at least recommended for transfusion of D negative females of childbearing potential to prevent D alloimmunization. However, there are scarce data about PC-induced alloimmunization against other Rhesus antigens than D.

Methods: We retrospectively determined the rate of Rhesus alloimmunization induced by C, c, E, e, and D incompatible PC transfusions at our institution during 08/2015 - 06/2016. The transfusion history of all patients being identified with a newly detected Rhesus-alloimmunization was analysed for Rhesus incompatible RBC and/or PC transfusions within the last 3 months.

Results: In 4 females and 3 males (age 54-81 years) we identified a total of 9 Rhesus-antibodies: 4x anti-D (one of them possibly being a booster-effect), 2x anti-c, 2x anti-E and 1x anti-f. Six of the seven patients received RBC-transfusions (total 76, range 3-32). All RBC units were antigen-negative for the respectively identified alloimmunization. Four of the 7 patients received BC-PC only (all of them only one unit), the reminder received 20/13, 10/7 and 5/1 BC-PC/AP-PC.

Conclusion: PC transfusions may not only induce Rhesus D alloimmunization, but also immunization against further Rhesus antigens. The risk seems obviously higher in case of BC-PC transfusions. Our study results may be taken into account for future specific recommendations of platelet transfusion with respect to their Rhesus compatibility.

Abstract No. 19

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Title:
RHESUS D ALLOIMMUNIZATION AND PATIENT OUTCOME AFTER TRANSIENTLY SWITCHING FROM D NEGATIVE TOWARDS D POSITIVE RED BLOOD CELLS IN CASE OF MASSIVE TRANSFUSION EPISODES

Text:
Background: There is often a shortage of Rhesus D negative (D-) red blood cell (RBC) units. For D- patients massive transfusion protocols (MTP) may therefore include a transient switching from D- RBC towards D+ RBC units as long as the acute bleeding episode has not adequately ceased. This saves D- RBC units, but may induce D-alloimmunization of the affected patients and may have an impact on their further outcome.

Methods: According to our standard operating procedure we switched from D- towards D+ RBC transfusions if a patient was transfused with at least 6 units within a massive bleeding episode and avoided doing so in females of childbearing age. We retrospectively (05/2010 - 10/2015) analysed our D- patients having been transiently switched to D+ RBC accordingly.

Results: A total of 73 patients were identified being transiently switched from D- towards D+ RBC transfusions if a patient was transfused with at least 6 units within a massive bleeding episode and avoided doing so in females of childbearing age. We retrospectively (05/2010 - 10/2015) analysed our D- patients having been transiently switched to D+ RBC accordingly.

Results: A total of 73 patients were identified being transiently switched from D- towards D+ RBC transfusions. They received 624 D+ RBC units (mean 8.5; median 5). Surviving patients (39) received 345 (mean/median = 8.8/5.0) and deceased (34) 279 (8.2/7.0) D+ RBC units. In 19/39 survivors (157 RBC units, 8.3/4.5) we could test for D-alloimmunization. In 13/19 tested patients (64 RBC units, 4.9/3.5) we found no anti-D (68%), in 6/19 survivors (93 RBC units, 15.5/5.5) an anti-D was detected at least 4 weeks after transfusion episode (32%).
Conclusion: Our study showed that switching transiently from D- towards D+ RBC in case of massive transfusion episodes significantly saves D- RBC units without an observable impact on patient outcome and with a low rate of alloimmunization.

Abstract No. 20

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Title: “WHOLE BLOOD FOR AFRICA”: REPRODUCIBILITY AND ROBUSTNESS OF INTERCEPT PATHOGEN INACTIVATION

Text: Introduction: The aim of the “Whole Blood for Africa” project (supported by the Humanitarian Foundation of the Swiss Red Cross) is to improve safety of transfusion practice in sub-Saharan Africa where blood availability in transfusion centers is frequently lacking and safety is often threatened by transfusion transmitted infections (TTI). The amustaline (S-303) technology is used for the INTERCEPT Blood System for Red Blood Cells (RBCs) for pathogen inactivation (PI) of contaminating bacteria, viruses or parasites in RBC components. This technology has been adapted for whole blood (WB) PI.

Methods: A total of 24 WB units (450 ± 3 mL, 40% HCT) representing the major blood groups (A, B, AB and O) and were either treated (Test) with 0.2 mM amustaline (S-303) and 2 mM glutathione (GSH) or left untreated (Control). Following an 18 hours hold at room temperature to allow for complete degradation of residual S-303, RBC function was measured immediately Post PI (day 2) and after 7 days storage at 4°C (Table 1).

Results: RBC function in PI WB, assessed by various metabolic parameters, was not significantly different from Control under the same storage conditions. These data are comparable to those previously obtained using a smaller number of WB units under the same conditions demonstrating the robustness of this process (Table 1). The low SD values indicate a very reproducible process in WB, across all major blood types

Abstract No. 21

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Title: A NOVEL SET TO POOL, FILTER AND SPLIT UP TO 6 UNITS OR 1500 ML OF PLASMA PRIOR TO INTERCEPT TREATMENT

Text: INTERCEPT pathogen inactivation (PI) technology is used for source and recovered plasma. To treat recovered plasma, approx. 2.5 units should be pooled to use full capacity of the INTERCEPT processing set (650 mL). Hence, 5 units are pooled and separated into 2 splits of 650 mL each with a commercially available set. Since the set has no filter, filtered plasma must be used to meet Swiss specifications, which leads to tradeoffs. For example, if whole blood filtration is used, buffy-coats lack platelets (plts). If component filtration is applied, often expensive blood collection sets have to be used. The latter approach is particularly uneconomic when most plasma is not used for transfusion but for fractionation not requiring filtered plasma. To solve this issue, we developed a set with filter.

Methods: We previously showed that whole blood filter RZ-2000 can remove white blood cells (WBC) from plasma without getting clogged (Goslings et al., Vox Sang 2012;103; suppl.1). Therefore, we designed a set based on this filter (Figure 1). Blood was collected with set NGR6428 (Fenwal) and separated into erythrocytes, buffy-coat and unfiltered plasma. Pools of 6 or 7 of these plasma units were processed with the set (26 pools, 8 spiked with WBC).

Results: Pools contained 1500 - 1899 mL plasma with WBC conc. up to 0.5970 x 10e3/µL and plts up to 33.6 x 10e9/L. After filtration, WBC were below detection limit of FACS and plts ≤ 4.1 x 10e9/L while FVIII and fibrinogen conc. did not change significantly (p > 0.05, n = 18). Av. total volume loss was 40 mL (n = 22) and filtration times were < 9 minutes.
**Conclusion:** Our set efficiently filters up to 6 units or 1500 mL of plasma for PI without affecting FVIII and fibrinogen.

![Diagram of plasma pooling set with integrated filter](image)

*Figure 3: Plasma pooling set with integrated filter*
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