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INTERCEPT® Blood System for Platelets Pathogen Reduction System

Publications including INTERCEPT treated platelets (INTERCEPT Platelets)

Topic

Topic	Citation
Mechanism of Action	
Mechanism of Action	**Wollowitz S.** Fundamentals of the psoralen-based Helinx technology for inactivation of infectious pathogens and leukocytes in platelets and plasma. Semin Hematol 2001;38:4-11.
In Vitro Pathogen Reduction – Bacteria	
Inactivation Data: In vitro study evaluating inactivation efficacy of INTERCEPT for high titers of bacteria. Following treatment, units were stored for 5 days under standard platelet storage conditions. No viable bacteria were detected in any treated unit after storage.	**Lin, L et al.** Photochemical treatment of platelet concentrates with amotosalen and UVA inactivates a broad spectrum of pathogenic bacteria. Transfusion, 2004. 44: p. 1496 – 1504.
Inactivation Data: In vitro study evaluating inactivation efficacy of INTERCEPT for platelet units spiked with bacteria. Samples were monitored by culture for 5 days post-collection. Detection of bacteria in the untreated platelet units was variable at lower titers and required extended culture times for some strains. None of the INTERCEPT Platelet units produced a positive culture result.	**Nussbaumer, W et al.** Prevention of transfusion of platelet components contaminated with low levels of bacteria: a comparison of bacteria culture and pathogen inactivation methods. Transfusion, 2007. 47(7): p. 1125-33.

Inactivation Data: In vitro study evaluating inactivation efficacy in whole blood, apheresis platelets, and buffy coat platelets spiked at two different concentrations and measured at two time points. Results demonstrate the need for minimal time period between blood donation and inactivation.	**Schmidt, M et al.** Evaluation of the effectiveness of a pathogen inactivation technology against clinically relevant transfusion-transmitted bacterial strains. Transfusion 2015 Sep;55(9):2104–12.

In Vitro Pathogen Reduction – Viruses and Parasites

Inactivation Data: Review that summarizes the inactivation efficacy of the INTERCEPT Blood System for a broad spectrum of viruses and parasites in platelet components.	**Lanteri, MC et al.** Inactivation of a broad spectrum of viruses and parasites by photochemical treatment of plasma and platelets using amotosalen and ultraviolet A light. Transfusion. 2020 Jun;60(6):1319-1331.

TA-GvHD

In Vivo GvHD Study: Evaluation of the efficacy of INTERCEPT to prevent transfusion-associated graft-versus-host disease (TA-GVHD) in vivo using a well-characterized murine transfusion model.	**Grass, JA et al.** Prevention of transfusion-associated graft-versus-host disease by photochemical treatment. Blood 1999;93(9): 3140-3147.
GvHD Review: Using a limiting dilution assay (LDA), the INTERCEPT Blood System demonstrates reduction of viable T-cells.	**Corash, L and L Lin,** Novel processes for inactivation of leukocytes to prevent transfusion-associated graft-versus-host disease. Bone Marrow Transplantation, 2004. 33: p. 1-7.
GvHD Review: INTERCEPT treatment results in ~ one amotosalen adduct per 83 base pairs, a sufficient frequency to ensure inactivation of most genes.	**Lin, L et al.** Protection against TA-GVHD due to platelet transfusion by using pathogen inactivation with the INTERCEPT Blood System: gamma irradiation is not the only answer. Haematologica, 2010. 95 (Suppl 1): p. 230-237.
In Vitro GvHD Study: Cytokine production was substantially inhibited in the sample treated with INTERCEPT.	**Hei, DJ, et al.** Elimination of cytokine production in stored platelet concentrate aliquots by photochemical treatment with psoralen plus ultraviolet A light. Transfusion, 1999. 39: p. 239-48.

Clinical Trials

Randomized, Controlled Clinical Study: Evaluated viability of INTERCEPT Platelets in healthy subjects.	**Snyder, E et al.** Recovery and Lifespan of 111 Indium radiolabeled platelets treated with pathogen inactivation using amotosalen HCl (S-59) and UVA light. Transfusion, 2004. 44: p. 1732-1440.
Randomized, Controlled Clinical Study: Evaluated clearance of residual amotosalen in healthy subjects.	**Corash, L et al.** S-59 clearance and kinetics after transfusion of platelets treated with Helinx™ Technology. Transfusion, 2000. 40(S10): p. 137.

Randomized, Controlled Clinical Study: SPRINT study. Evaluated safety, efficacy of INTERCEPT Platelets. Primary endpoint was Grade 2 bleeding (primary endpoint met). (N=645)	**McCullough, J et al.** Therapeutic efficacy and safety of platelets treated with a photochemical process for pathogen inactivation: the SPRINT Trial. Blood, 2004. 104(5): p. 1534-41.
Follow Up Analysis for SPRINT Study: Analyzed platelet dose to determine the impact of the number of platelets transfused on transfusion requirements. Lower CIs and shorter transfusion intervals for INTERCEPT Platelets suggest that platelet injury may occur during treatment; however, this injury did not result in increase in bleeding.	**Murphy, S et al.** Platelet dose consistency and its effect on the number of platelet transfusions for support of thrombocytopenia: an analysis of the SPRINT trial of platelets photochemically treated with amotosalen HCl and ultraviolet A light. Transfusion. 2006 Jan;46(1):24-33.
Randomized, Controlled Clinical Study: (Not an INTERCEPT study) PLADO study. Evaluated platelet dose on bleeding in patients.	**Slichter, SJ et al.** Dose of prophylactic platelet transfusions and prevention of hemorrhage. N Engl J Med, 2010. 362:600-613.
Randomized, Controlled Clinical Study: Evaluated safety, efficacy of INTERCEPT Platelets. Primary endpoint was 1 hr platelet count increment (primary endpoint met). (N=43)	**Janetzko, K et al.** Therapeutic efficacy and safety of photochemically treated apheresis platelets processed with an optimized integrated set. Transfusion, 2005. 45(9):1443-1452.
Randomized, Controlled Clinical Study: Evaluated safety of INTERCEPT Platelets. Primary endpoint was bleeding time (primary endpoint met). (N=32)	**Slichter, SJ et al.** Platelets photochemically treated with amotoslaen HCl and ultraviolet A light correct prolonged bleeding times in thrombocytopenic patients. Transfusion, 2006. 46:731-740.
Prospective, Open-Label Clinical Study: PIPER study. Evaluated safety of INTERCEPT Platelets. Primary endpoint was assisted mechanical ventilation (primary endpoint met). (N=2,291)	**Snyder, EL et al.** Comparative risk of pulmonary adverse events with transfusion of pathogen reduced and conventional platelet components. Transfusion. 2022 Jul;62(7):1365-1376.

Hemovigilance and Routine Use

Hemovigilance: Evaluated the risk of transfusion reactions and transfusion transmitted infections as the frequency of INTERCEPT Platelet routine use increased over an 11 year period (N=1,221,031 INTERCEPT Platelets; 2,160,367 conventional platelets) (France).	**Pitman, JP et al.** Longitudinal analysis of annual national hemovigilance data to assess pathogen reduced platelet transfusion trends during conversion to routine universal clinical use and 7-day storage. Transfusion. 2023 Apr;63(4):711-723.
Hemovigilance: Reviewed HV data to determine relative efficacy of LVDS (UK, Ireland) and INTERCEPT Platelets treatment (Belgium, France, Switzerland).	**Benjamin, RJ et al.** Hemovigilance monitoring of platelet septic reactions with effective bacterial protection systems. Transfusion. 2017 Dec;57(12):2946-2957.
Routine Use: Compared platelet and RBC utilization during two 21-month periods, before and after INTERCEPT Platelet implementation in hematology/oncology, cardiac surgery, pediatric and neonatal populations (Austria).	**Amato M, et al.** Impact of platelet pathogen inactivation on blood component utilization and patient safety in a large Austrian Regional Medical Centre. Vox Sang. 2017 Jan;112(1):47-55.

Routine Use: Compared component use, in-hospital mortality and length of stay for massively transfused patients during two 21-month periods, before and after INTERCEPT Platelet implementation (Austria).	**Nussbaumer W al.** Patient outcomes and amotosalen/UVA-treated platelet utilization in massively transfused patients. Vox Sang. 2017;112(3):249-256.
Hemovigilance: Characterized safety profile for INTERCEPT Platelets when transfused to >4,000 patients over 7 years, across 11 countries.	**Knutson F et al.** A prospective, active haemovigilance study with combined cohort analysis of 19,175 transfusions of platelet components prepared with amotosalen-UVA photochemical treatment. Vox Sang. 2015 Nov;109(4):343-52.
Hemovigilance: Evaluated safety of INTERCEPT Platelets in 1,400 patients (Belgium).	**Osselaer, JC et al.** An active haemovigilance programme characterizing the safety profile of 7437 platelet transfusions prepared with amotosalen photochemical treatment. Vox Sang, 2008. 94(4):315-23.
Hemovigilance: Evaluated safety of INTERCEPT Platelets in ~650 patients (Belgium).	**Osselaer, JC et al.** A prospective observational cohort safety study of 5106 platelet transfusions with components prepared with photochemical pathogen inactivation treatment. Transfusion, 2008. 48(6):1061-71.
Hemovigilance: Evaluated platelet and RBC utilization 3 years before and 3 years after INTERCEPT Platelet implementation (Belgium).	**Osselaer, JC et al.** Universal adoption of pathogen inactivation of platelet components: impact on platelet and red blood cell component use. Transfusion, 2009. 49(7):1412-22.
Hemovigilance: Evaluated Platelet and RBC utilization, safety post INTERCEPT Platelets implementation (France).	**Cazenave, J et al.** Use of additive solutions and pathogen inactivation treatment of platelet components in a regional blood center: impact on patient outcomes and component utilization during a 3-year period. Transfusion, 2011. 51(3):622-9.
Routine Use: Evaluated frequency of acute transfusion reactions in routine setting (Germany). (N=51)	**Schlenke, P et al.** Safety and clinical efficacy of platelet components prepared with pathogen inactivation in routine use for thrombocytopenic patients. Ann Hematol, 2011. 90(12):1457-65.
Routine Use: Evaluated frequency of acute transfusion reactions in routine setting (Switzerland). (N=46)	**Infanti, L et al.** Pathogen-inactivation of platelet components with the INTERCEPT Blood System : a cohort study. Transfus Apher Sci, 2011. 45(2):175-81.
Routine Use: Analyzed platelet utilization, RBC transfusion trends, and transfusion reaction rates data from adult patients transfused with INTERCEPT Platelets. US; (Yale-New Haven Hospital).	**Bahar B et al.** Blood utilisation and transfusion reactions in adult patients transfused with conventional or pathogen-reduced platelets. Br J Haematol. 2020 Feb;188(3):465-472.

Toxicity Studies

Toxicity: Animal studies (rats, dogs) evaluating toxicology and kinetics of INTERCEPT Platelets.	**Ciaravino, V et al.** Pharmacokinetic and toxicology assessment of INTERCEPT (S-59 AND UVA treated) platelets. Human and Experimental Toxicology, 2001. 20:533-550.
Toxicity: Studies conducted in neonatal rats to evaluate the safety of INTERCEPT-treated blood components for neonates. No reproductive or developmental toxicities observed.	**Ciaravino, V et al.** Assessment of safety in neonates for transfusion of platelets and plasma prepared with amotosalen photochemical pathogen inactivation treatment by a 1-month intravenous toxicity study in neonatal rats. Transfusion 2009; 49:985–994.
Toxicity: Reviews the genotoxicity profile of INTERCEPT Platelets, and assesses the mutagenic and carcinogenic hazards in recipients of treated components. No genotoxicity or mutagenicity observed.	**Tice, RR et al.** The pathogen reduction treatment of platelets with S-59 HCl (Amotosalen) plus ultraviolet A light: genotoxicity profile and hazard assessment. Mutation Research 2007;630:50-68.

Pediatrics

Pediatrics/Neonatal: Assessed safety and efficacy of INTERCEPT Platelets in NICU and pediatric patients (Yale-New Haven Hospital).	**Schulz, WL et al.** Blood Utilization and Transfusion Reactions in Pediatric Patients Transfused with Conventional or Pathogen Reduced Platelets. J Pediatr. 2019 Jun;209:220-225.
Pediatrics/Neonatal: Evaluated rates of transfusion and transfusion reactions for INTERCEPT Platelets in pediatric and neonatal patients (UCLA).	**Lasky, B et al.** Pathogen-reduced platelets in pediatric and neonatal patients: Demographics, transfusion rates, and transfusion reactions. Transfusion. 2021 Oct;61(10):2869-2876.
Pediatrics: Evaluated transfusion reaction rates in pediatric patients that received INTERCEPT Platelets, across 4 centers in 3 countries.	**Delaney, M et al.** Multinational Analysis of Children Transfused With Pathogen Inactivated Platelets. Hosp Pediatr. 2022 Mar 1;12(3):311-316.
Pediatrics: Characterized the hemostatic efficacy of INTERCEPT Platelets in children undergoing cardiopulmonary bypass surgery (Cornell).	**Hsien, S et al.** Hemostatic efficacy of pathogen-reduced platelets in children undergoing cardiopulmonary bypass. Transfusion. 2022 Feb;62(2):298-305.

Economics

Economics: Compares annual costs and savings for INTERCEPT Platelets and LVDS tested platelets via a budget impact model.	**Prioli, KM et al.** "Economic implications of FDA platelet bacterial guidance compliance options: Comparison of single-step strategies," Transfusion. 2022;1–9.

Economics: Compares annual costs and savings for INTERCEPT Platelets and Point of Issue tested platelets via a budget impact model.	**Prioli, KM et al.** Economic Implications of Pathogen Reduced and Bacterially Tested Platelet Components: A US Hospital Budget Impact Model. Appl Health Econ Health Policy. 2018 Dec;16(6):889-899.Dec;16(6):889-899.

US Implementation

Implementation (Stanford): Assessed transition from a mixed INTERCEPT Platelet /culture inventory to 100% INTERCEPT Platelet inventory.	**Shu, E et al.** "Implementation strategy for complete pathogen reduction technology treated apheresis platelet inventory," Transfusion. 2022;1–9.
Implementation (UCLA): Describes phased implementation of INTERCEPT Platelets in self-collecting hospital.	**Nguyen, JT et al.** "How do we implement pathogen reduction technology, while maintaining an adequate platelet inventory for our patients?," Transfusion. 2021;1–9.
Implementation (Stanford): Assessed decision to implement INTERCEPT Platelets, including shelf-life and use of variable dose platelets.	**Pham, TD et al.** How do I implement pathogen-reduced platelets? Transfusion. 2021 Dec;61(12):3295-3302.
Implementation (UCSD): Describes phased implementation to reach >90% INTERCEPT Platelet inventory.	**Allen, ES et al.** Phased implementation of pathogen-reduced platelets in a health system facilitates increased manufacturing at the blood center. Transfusion. 2019 Oct;59(10):3120-3127.
Implementation (Yale-New Haven): Describes early adopter's approach to implementing INTERCEPT Platelets.	**Rutter, S et al.** How do we … integrate pathogen reduced platelets into our hospital blood bank inventory? Transfusion. 2019 May;59(5):1628-1636.

Other

Strategies for Prevention of Bacterial Contamination: Overview of the risk of bacterial contamination of platelets and a comparison of the strategies and technologies (including INTERCEPT) for the prevention, detection, and reduction/inactivation of bacterial contaminants in platelets.	**Levy, JH et al.** Bacterial contamination of platelets for transfusion: strategies for prevention. Crit Care. 2018 Oct 27;22(1):271.
Underreporting of Bacterial Contamination: Retroactively evaluated patient records for those who received bacterially contaminated platelets; assessed missed contaminated unit and sepsis events due to passive surveillance.	**Hong, H et al.** Detection of septic transfusion reactions to platelet transfusions by active and passive surveillance. Blood. 2016 Jan 28;127(4):496-502.
Underreporting of Bacterial Contamination: Commentary on Hong et al. paper. Indicates that patient risk is 10- to 40-fold higher with passive hemovigilance.	**Benjamin, RJ et al.** Transfusion-related sepsis: a silent epidemic. Blood. 2016 Jan 28;127(4):380-1.

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