Censoring occurred at the time of death, loss to follow up or 10 years. Univariable and multivariable hazard ratios (HR) were calculated using a Cox model, treating relapse and rejection following CMV as time-varying covariates.

**Results.** Seventy-nine kidney, 52 heart, 34 liver and five liver-kidney transplant recipients were included. Sixty-two of 170 died, at a median of 3.8 years (interquartile range [IQR] 0.8–6.6 years). Median follow up amongst the 108 survivors was 7.4 years (IQR 3.7–10 years) although 22 (13%) were censored before 3 years. CMV relapse occurred in 49/170 (29%), 67% within 6 months of treatment completion. Overall mortality amongst those who relapsed was 39% (19/49) vs. 36% (43/121) in those who remained relapse free. On univariable analysis, CMV relapse was not associated with a significantly increased risk of death (unadjusted HR 1.59, 95% CI 0.92–2.75, P = 0.10). After controlling for age and transplanted organ type, findings were similar (adjusted HR 1.6, 95% CI 0.93–3.04, P = 0.09).

**Conclusion.** Mortality rates following CMV remain high even in the valganciclovir era. In our study, we did not identify a significant relationship between the development of recurrent CMV disease and death. However, the complex nature of these patients, multiple layers of potential confounding and limited statistical power of our cohort make detection of small effects difficult. Future prospective studies evaluating the clinical efficacy of strategies to reduce recurrence are needed to further assess this relationship.

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### 1552. Absolute Lymphocyte Count Threshold: A Simple Readily Available Tool to Predict Risk of Cytomegalovirus Infection After Transplantation

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**Background.** Cytomegalovirus (CMV) is a common infection after solid-organ (SOT) and hematologic stem cell transplantation (HSCT). We correlated peripheral blood absolute lymphocyte count (PBALC) with risk of CMV infection in transplant patients.

**Methods.** Thirty-six SOT and 28 HSCT consecutive patients with plasma CMV viral load (VL) testing for surveillance were enrolled. Clinical variables, including PBALC, were abstracted for correlation with CMV infection.

**Results.** Among HSCT recipients, PBALC <520 (300–560) cells/mm³ correlated with CMV infection (sensitivity 100%; specificity 80%); median PBALC was lower among those who developed CMV infection (520 and 510 vs. 1,020 cells/mm³) (Table 1).

**Conclusion.** In the current era when sophisticated immunologic measures are being employed as CMV prognosticator, we highlight the clinical importance of a simple readily available PBALC.

**Table 1.** CMV VL and PBALC in Patients with or Without CMV Infection

| CMV Disease | Asymptomatic CMV Viremia | No CMV infection\(P\) Value |
|-------------|--------------------------|-----------------------------|
| SOT, N = 36 | N = 7 | N = 18 | N = 11 |
| Median CMV VL (IU/mL) | 32,500 (352–118,000) | 423 (297–6,315) | 0.005* |
| Median PBALC (cells/mm³) | 270 (140–440) | 450 (388–675) | 1.120 (590–1,400) |
| HSCT, N = 28 | N = 3 | N = 15 | N = 10 |
| Median CMV VL (IU/mL) | 1,220 | 884 (347–1,980) | 0.62* |
| Median PBALC (cells/mm³) | 520 (300–560) | 510 (330–670) | 1,020 (795–3,308) |

PBALC, peripheral blood absolute lymphocyte count; CMV, cytomegalovirus; HSCT, hematologic stem cell transplantation; IQR, interquartile range; SOT, solid-organ transplantation; VL, viral load.

*Comparison between CMV disease and CMV viremia recipients.

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### 1553. Infectious Complications Following Hematopoietic Cell Transplantation in Patients With Primary Immunodeficiency Diseases

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**Background.** Hematopoietic cell transplantation (HCT) has significantly improved long-term survival for children with primary immunodeficiency diseases (PID). Little is known about specific risk factors for infections after transplant in PID patients and differences from others undergoing HCT. Factors impacting success of HCT in PID include age at HCT, underlying genetic defect, type of donor and conditioning regimen, and importantly, the presence of pre-existing infection. We describe the epidemiology and risk factors for bacterial, viral and fungal infections in patients undergoing HCT for PID.

**Methods.** After IRB approval, medical records of patients undergoing HCT at Seattle Children’s Hospital for PID between 1998 and 2017 were reviewed. Donor and stem cell source, conditioning regimen, development of graft vs. host disease (GVHD), chimerism and mortality were considered, in addition to details of pre-HCT infections. Timing, character and treatment details of each incident infection during 12 months post-HCT were collected. Standardized antimicrobial prophylactic regimens were administered. Primary outcomes included mortality and infection-free survival. Kaplan–Meier curves were used to examine infection-free survival, by diagnosis and by HCT era.

**Results.** Sixty-nine patients with PID underwent HCT during the study period. Mean age at HCT was 6.2 years and varied by underlying PID. Altogether, 24 children (34.8%) had severe combined immune deficiency (SCID), 14 (20.3%) had chronic granulomatous disease (CGD), nine (13%) had combined immune deficiency (CID), and six (8.7%) had hypogammaglobulinemia. Fifty-six patients received HLA-matched grafts. Umbilical cord blood was utilized in 10% of patients. Acute GVHD grades II–IV developed in 46 (67%) patients. Bacterial infections were the most common infection post-HCT, followed by respiratory and herpes group viral infections. Overall mortality at 1 year was 19%, of which at least 50% was infection related.

**Conclusion.** Infection occurs frequently and contributes to morbidity and mortality in patients undergoing HCT for PID. Understanding the timing of infections and contributing risk factors could help develop preemptive and monitoring strategies to improve outcomes in this patient population.
Reactivation of Varicella Zoster Virus in Solid Organ Transplant Recipients: Identification of Risk Factors Using Data Mining Tools

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Background. We created a retrospective database of solid-organ transplant (SOT) recipients using innovative data mining tools. This study describing the epidemiology of Varicella Zoster Virus (VZV) reactivation in SOT serves as a proof of concept of such techniques in clinical research.

Methods. The study design was a retrospective single-center cohort study. Using data mining tools, information was extracted from the electronic medical record and merged with data from the Scientific Registry of Transplant Recipients. First SOT from January 1, 2010–December 31, 2016 were included. Charts of subjects with ICD9/10 codes related to VZV/Herpes infections; positive VZV PCR, DFA or cultures; and recipients of acyclovir, valacyclovir or famciclovir were manually reviewed. The cumulative incidence was calculated using the Kaplan–Meier method. Cox proportional hazards models were used to identify risk factors for VZV reactivation among heart transplant (HT) recipients.

Results. A total of 1,076 SOT recipients met inclusion criteria (203 heart, 395 lung, 280 kidney, 198 liver). Forty-nine patients experienced at least one episode of VZV reactivation; median time post-transplant was 2.25 years (IQR 1.44–4.20 years). The cumulative incidence was 11.9% at 8 years post-transplant. Heart transplant (HT) recipients were at highest risk (Figure 1), with an 8-year cumulative incidence of 26.3% (Figure 2). Thirty-nine of 49 (80%) patients presented with localized disease and 4/49 (8%) with disseminated disease. In multivariable analysis, no risk factors for PHN were identified.

Figure 1

| Patient Characteristics (Heart Transplant Recipients, N=203) |
|-------------------------------------------------------------|
| Age (median) | 58 | ±12.4 |
| Gender (Male) | 147 | 72.4% |
| Race/Ethnicity | | |
| Caucasian | 133 | 65.5% |
| African American | 48 | 23.6% |
| Hispanic | 16 | 7.9% |
| Asian | 6 | 3.0% |
| Diabetes Mellitus | 78 | 38.4% |
| Underlying Disease | | |
| Ischemic Cardiomyopathy | 81 | 39.9% |
| Non-Ischemic Cardiomyopathy | 98 | 48.3% |
| Other | 24 | 11.8% |
| UNOS listing status | | |
| 1A | 156 | 76.8% |
| 1B | 43 | 21.2% |
| 2 | 4 | 2.0% |
| Pre-Transplant VZV IgG seropositivity | 187 | 92.1% |
| CMV serostatus | | |
| CMV D+/R- | 58 | 28.6% |
| CMV D+/R+ | 127 | 62.6% |
| CMV D-/R- | 18 | 8.9% |
| CMV infection | 28 | 13.8% |
| Pre-transplant LVAD | 71 | 35.0% |
| Post-transplant ECMO | 9 | 4.4% |
| Post-transplant RRT | 21 | 10.3% |
| Rejection | 62 | 30.5% |
| Pulse Steroids | 30 | 14.8% |
| Induction Immunosuppression (Basiliximab) | 201 | 99.0% |
| Maintenance Immunosuppression (at 1 yr) | | |
| Prednisone | 89 | 43.8% |
| Cyclosporine | 99 | 48.8% |
| Tacrolimus | 83 | 40.9% |
| Azathioprine | 66 | 32.5% |
| MMF/MPA | 117 | 57.6% |
| Other (Methotrexate/Sirolimus) | 13 | 6.4% |
| Maintenance Immunosuppression Regimen (at 1 yr) | | |
| CyA/Aza, CyA/Myc, Tac/Aza, Tac/Myc, Aza/Si, Pred/Myc, Pred/Tac, Cyc/Myc/Si, Pred/Tac/Myc/Si | 101 | 49.8% |
| CyA/CyA, Pred/Myc, Pred/Myc/Si, Pred/Tac/Aza, Pred/Tac/CyA, Pred/CyA | 76 | 37.4% |
| Pred/Tac/Myc, Pred/Tac/Myc/Si | 9 | 4.4% |
| Slow steroid taper (12 months) | | |
| Aza/MTX | 40 | 19.7% |

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