Antimicrobial Prophylaxis by Organism in Pediatric Transplant Patients

Team:	Heart Transplant	Liver Transplant	Kidney Transplant	Bone Marrow Transplant
		Cytomegalovirus		
Primary Prophylaxis: *(See specific team guidelines for treatment and secondary prophylaxis)* *Heart/Liver: start prophylaxis after transplant* *Kidney: start prophylaxis when able to take PO*	**High Risk: D+R- (any age)** **OR D_{ANY}R+ (<12m old)** **OR D+R+ (s/p IVIG/PLEX)[1]** • Ganciclovir/Valganciclovir x3 months post-transplant	**High Risk: D+R- (any age)** **OR D+R+ (<12m old)** • Ganciclovir/Valganciclovir x6 months post-transplant	**High Risk: D+R-** • Valganciclovir x6 months	**High-risk: D-R+ OR D+R+** i. If patient age and weight allow for appropriate dosing • Letermovir x100 days[2] ○ 480mg once daily po or iv ○ 240mg daily po or iv if concurrently receiving cyclosporine ○ Duration may be extended if patient is on continued immunosuppression ii. Preemptive monitoring if not able to dose Letermovir
	Moderate Risk: R+ (>12 months of age) • No CMV-active antiviral prophylaxis administered • Preemptive PCR monitoring	**Moderate Risk: R+ (>12 months of age)** • Ganciclovir/Valganciclovir x3 months post-transplant	**Moderate Risk: R+** • Valganciclovir x6 months	
	Low Risk: D-R- (any age) • No CMV-active antiviral prophylaxis administered • Preemptive PCR monitoring	**Low Risk: D-R- (any age)** • No CMV-active antiviral prophylaxis administered	**Low Risk: D-R-** • No CMV-active antiviral prophylaxis administered	**Low risk: D+R-** May consider Letermovir prophylaxis if other risk factors for CMV infection—(ex: alemtuzumab prep, recent CMV infection pre-transplant) Otherwise, preemptive monitoring
Lab Monitoring:	**High/Moderate Risk:** CMV qPCR weekly x6 weeks, then every 2 weeks until 6 months **Low Risk:** CMV qPCR monthly x6 months, CMV IgM/IgG at annual visits until positive	**All Risk levels:** CMV qPCR monthly x1 year post-transplant **Following prophylaxis discontinuation:** CMV qPCR every 2 weeks x6 weeks thereafter , at year 1 visit, then PRN	**High Risk:** CMV qPCR on post-op months 8, 10, & 12 **Moderate Risk:** CMV qPCR on post-op month 6 **Low Risk:** CMV qPCR at 1-month post-transplant	**High/Moderate Risk:** CMV qPCR weekly until off immune suppression **Low Risk:** Symptomatic
VUMC Guideline:	Box>Wright Service>Heart Transplant>CMV prophy *Last update:* 9/30/2021	Box>Wright Service>Liver Transplant>CMV prophy *Last update:* 9/5/2018	No written protocol	VICC website>Intranet for Faculty/Staff>BMT Clinical Program SOPs>Pediatric SOPs>CPGs>Ch1 *Last update: 9/15/2021*
Literature link:	International Consensus Guidelines on CMV in SOT American Society of Transplantation- CMV in SOT			Letermovir Prophylaxis in HCT

1: In patients receiving IVIG/PLEX, a positive recipient CMV IgG cannot be interpreted or trusted—therefore, should be treated as if R negative (treat as high risk if donor is positive)
2: FDA approved for ≥18 years of age; we are using in patients ≥16 years of age if they are adult weight

Team:	Heart Transplant	Liver Transplant	Kidney Transplant	Bone Marrow Transplant
Herpes Simplex Virus				
Primary Prophylaxis: *(See specific team guidelines for treatment and secondary prophylaxis)*	Acyclovir administered to all recipients if not receiving valganciclovir CMV prophylaxis • Duration: 3 months post-transplant	Acyclovir administered to HSV seropositive recipients if not receiving valganciclovir CMV prophylaxis • Duration: 1 month post-transplant	None	**High risk: R+ OR R- but has received VZV vaccine** • Start Valacyclovir or acyclovir on day 0, continue x1 year post-transplant or until 30 days after immunosuppressive therapy discontinuation—*whichever is longer* ○ Also serving as VZV prophylaxis **Low Risk:** none
Lab Monitoring:	*None/symptomatic*	*None/symptomatic*	*None/symptomatic*	*None/symptomatic*
VUMC Guideline:	None See acyclovir duration currently listed in CMV prophylaxis guideline	None	None	VICC website>Intranet for Faculty/Staff>BMT Clinical Program SOPs>Pediatric SOPs>CPGs>Ch1 *Last update: 9/15/2021*
Literature:	HSV infections in SOT: Guidelines from the AST (Clinical Transplantation, 2019)			HSV reactivation after BMT (BBMT, 2015) VZV after BMT in children (Medicine, 2017)

Team:	Heart Transplant	Liver Transplant	Kidney Transplant	Bone Marrow Transplant
Pneumocystis Jiroveci				
Primary Prophylaxis: *(See specific team guidelines for treatment and secondary prophylaxis)* *Note: specific team guidelines detail restarting prophylaxis in those off 1° ppx who then require treatment for rejection*	**All patients:** Bactrim MWF started at discharge or on POD10 (whichever is earlier) x6 months post-transplant* *Stop ONLY if: no current oral steroids, no rejection x3m, no IV pulse steroids x3m, no thymoglobulin or rituximab x6m, no prior episodes of PJP, toxo serology testing negative at 6 months *Consider alternative antibiotic if: WBC<3000, ANC<1000, platelets<100, AST/ALT >2x upper limit, allergy/SJS/GI intolerance* 2nd line: atovaquone or dapsone (adolescents) 3rd line: inhaled pentamidine	**All patients:** Bactrim MWF started on POD5-7 x6 months post-transplant* *Stop ONLY if: no rejection x3m, no IV pulse steroids x3m, no thymoglobulin or rituximab x6m, no prior episodes of PJP *Consider alternative antibiotic if: ANC<500, platelets<100, AST/ALT >2x upper limit, allergy/SJS/GI intolerance* 2nd line: inhaled pentamidine 3rd line: atovaquone or dapsone	**All patients:** Bactrim *daily* started once taking PO x1 year post-transplant* • Daily because also serving as UTI prophylaxis *If ongoing PJP ppx required after 1 year (for history PJP infection), and no longer needing UTI ppx, Bactrim reduced to MWF	**All patients:** start day -1 with monthly inhaled pentamidine • Switch to Bactrim MWF post-engraftment + stable cell counts without product/factor support • **Allogenic:** stop once off immunosuppression + CD4 count >200 • **Autologous:** stop at 6 months post transplant
Lab Monitoring:	None/symptomatic	None/symptomatic	None/symptomatic	None/symptomatic
VUMC Guideline:	VTC P&P> Pediatric Transplant> Heart> Post-transplant Mgmt> PJP *Last update: 7/2020*	Box> Wright Service> Liver Transplant> PJP prophy *Last update: 4/12/2022*	No written protocol	VICC website>Intranet for Faculty/Staff>BMT Clinical Program SOPs>Pediatric SOPs>CPGs>Ch1 *Last update: 9/15/2021*
Literature:	Review: *Pneumocystis* pneumonia in solid organ transplantation AST ID Community of Practice: *Pneumocystis jiroveci* in SOT			ECIL guidelines for preventing PJP in BMT (2016)

Team:	Heart Transplant	Liver Transplant	Kidney Transplant	Bone Marrow Transplant
Antifungal Prophylaxis				
Primary Prophylaxis: *(See specific team guidelines for treatment and secondary prophylaxis)*	**All patients:** Nystatin starting post-op until 90 days post-transplant* *Older children not tolerating nystatin who are off steroids and without rejection may stop at transplant hospitalization discharge.	**Standard risk:** start post-op day 1 with q8h oral nystatin until off steroids **High risk[2]:** start day -1 or transplant day with daily fluconazole PO/IV and continue x7 days post-transplant then transition to oral nystatin until off steroids	**All patients:** start oral nystatin after transplant and continue x12 months	**High risk[1] allogenic recipients:** start on day -1 with daily Posaconazole; continue for 6 months post-transplant (alt: micafungin, isavuconazole) • If unable to swallow pills, Voriconazole **Non-high risk allogenic recipients:** start on day -1 with daily Fluconazole, continue until day 100 post-transplant (alt: micafungin) **Autologous recipients:** start on day -1 with daily Fluconazole, continue until engraftment (alt: micafungin)
Lab Monitoring:	*No routine fungal testing; symptomatic only*	*No routine fungal testing; symptomatic only*	*No routine fungal testing; symptomatic only*	**High risk:** Posaconazole trough after 7 days; goal trough 0.75-1.5 µg/mL (Vori: 1-2 µg/mL) *No routine fungal testing; symptomatic only*
VUMC Guideline:		Box> Wright Service> Liver Transplant> Fungal proph *Last update: 4/12/2022*	No written guideline	VICC website>Intranet for Faculty/Staff>BMT Clinical Program SOPs>Pediatric SOPs>CPGs>Ch1 *Last update: 9/15/2021*
Literature:	Review: Candida infections in solid organ transplantation			GITMO consensus guidelines for primary prophylaxis of invasive fungal disease in BMT

1 High risk allogenic recipients= all cord, haplo or mismatched recipients; prolonged neutropenia pre-transplant; received Campath, ATG, or donor T-cell depletion; prolonged steroid use (>1 mg/kg)

2 High risk liver transplant recipients, DEFINITE: re-transplantation; ICU admission ≥48 hours prior to transplant (excluding planned ICU admissions pre-transplant); OTHER CONSIDERATIONS: OR time >10h, intra-op volume infusion >300 ml/kg, exposure to broad spectrum antibiotics

Team:	Heart Transplant	Liver Transplant	Kidney Transplant	Bone Marrow Transplant
Peri-transplant antibiotics				
Primary Prophylaxis: *(See specific team guidelines for treatment and secondary prophylaxis)*	**Standard risk:** cefazolin x24 hours post-op **MRSA risk:** If MRSA colonization on nasal culture, nasal PCR, or recent infection → vancomycin instead of cefazolin **Allergy risk:** cephalosporin or severe beta-lactam → vancomycin **Delayed chest closure:** continue above antimicrobial x 24 hours following chest closure	**All patients:** start antibiotic 30 minutes prior to incision, continue x24 hours post-op **Standard risk:** ampicillin-sulbactam **High risk (retransplant, dialysis pre-transplant, or planned biliary enteric anastomosis):** piperacillin-tazobactam **MRSA risk:** vancomycin + amp-sulbactam (or pip-tazo) **Allergy risk:** severe beta-lactam → vancomycin + aztreonam	**All patients:** start cefazolin in OR, occasionally re-dose for long cases; not continued post-op unless clinically indicated *Rarely, different antibiotic used on case-by-case basis if indicated due to recent/recurrent infection, ie MRSA coverage*	**Peri-transplant period (all BMT):** start day 1 with levofloxacin, continue through engraftment or F&N protocol initiated (alt: cefepime) **High risk, post-engraftment period[1]:** restart or continue levofloxacin until 2 weeks post-etanercept completion or when steroid dose approaches physiologic dosing **High risk, encapsulated organisms[2]:** once off levofloxacin, start penicillin VK • cGVHD: stop once off all IST for >1 month + completed Prevnar, HiB, Men vaccine series • Splenectomized: continue indefinitely **Hypogammaglobulinemia[3]:** when IgG <400 mg/dL, give IVIG 400 mg/kg
Lab Monitoring:	MRSA swab pre-op to determine vancomycin vs. cefazolin peri-op prophylaxis	**All patients:** UA/UCx with pre-op labs (do not cath)	*No routine bacterial testing, symptomatic only*	**Hypogammaglobulinemia:** allogenic recipients should have IgG level monthly until recovery of humoral immunity *No routine bacterial testing, symptomatic only*
VUMC Guideline:	Surgical antimicrobial prophylaxis table	Box> Wright Service> Liver Transplant> Bacterial prophylaxis *Last update: 2/8/2022*	No written protocol	VICC website>Intranet for Faculty/Staff>BMT Clinical Program SOPs>Pediatric SOPs>CPGs>Ch1 *Last update: 9/15/2021*
Literature:	AST ID Community of Practice: Guidelines for Surgical Site Infections in SOT			RCT meta-analysis of antibiotic prophylaxis in hematopoietic SCT

1: acute GI GVHD on methylprednisolone >1 mg/kg/day; neutropenia >7 days; on Etanercept; cGVHD with persistent GI symptoms
2: cGVHD, splenectomized patients
3: allogenic recipients until recovery of humoral immunity; cGVHD; those undergoing B-cell directed therapies

Antiviral prophylaxis dosing

Antiviral:	Transplant team:	Dosing:	Renal Dosing:
Ganciclovir (IV)	Heart	**All ages:** 5 mg/kg/dose q24h	**CrCl 50-69**= 2.5 mg/kg/dose q24h, **CrCl 25-49**= 1.25 mg/kg/dose q24h, **CrCl 10-24**= 0.625 mg/kg/dose q24h, **CrCl <10**= 0.625 mg/kg/dose 3x/wk (after hemodialysis)
	Liver		
	Kidney	*Not specified*	*Not specified*
Valganciclovir (PO)	Heart	**Age <4m**: 15 mg/kg/dose q24h **Age 4m to 17y**: 7xBSAxCrCl$^{\text{mod. Schwartz}}$ q24h →max 900 mg q24h **Age ≥17y:** 900 mg/dose q24h	**CrCl 40-59**= 450 mg q24h, **CrCl 25-39**= 450 mg q48h, **CrCl 10-24**= 450 mg 2x/wk, **CrCl <10**= avoid VGC, use ganciclovir *(Applies only to >17y or those meeting max weight based dose)*
	Liver	Same dosing as heart, with different age cut offs: **0 to <6y**, **≥6y to 16y**, **≥17y**	Same as heart, but add: if CrCl<60 for 0 to <6y patient, switch to 7xBSAxCrCl dosing
	Kidney	*Not specified*	*Not specified*
Acyclovir (PO) *Not active against CMV at prophylaxis dosing*	Heart	**All ages:** 20 mg/kg/dose q12h → max 800 mg q12h	If CrCl <10, adjust dose to 50% weight based dosing q12h
	BMT	**Age <6y**: 200 mg BID **Age ≥6y**: 400 mg BID *If no PO, IV acyclovir 2.5 mg/kg/dose q12h*	*Not specified*
Valacyclovir (PO) *Not active against CMV at prophylaxis dosing*	BMT	**All ages:** 20 mg/kg/day 1-2x daily → max 500 mg BID *If no PO, IV acyclovir 2.5 mg/kg/dose q12h*	*Not specified*
Letermovir *Not active against HSV/VZV*	BMT	**Age ≥16 years and weight >30 kg** **Off cyclosporine:** 480 mg q24h (PO or IV) **On cyclosporine:** 240 mg q24h (PO or IV)	*No renal adjustments*