Correction to: Older HIV-infected adults: complex patients (III)—polypharmacy

Samuel F. Freedman¹ · Carrie Johnston² · John J. Faragon³ · Eugenia L. Siegler⁴ · Tessa Del Carmen⁴

Published online: 20 May 2019

© European Geriatric Medicine Society 2019

Correction to: European Geriatric Medicine (2019)
<https://doi.org/10.1007/s41999-018-0139-y>

The original version of this article unfortunately contained a mistake. In Table 2, the dosing of tenofovir-containing medication was incorrect: For TAF, no dose adjustment is required for patients with CrCl 30 ml/min or higher. When CrCl is < 30 ml/min, TAF is not recommended. For TDF, providers should dose adjust if CrCl is < 50 mL/min. The corrected Table 2 is given below.

The original article can be found online at <https://doi.org/10.1007/s41999-018-0139-y>.

✉ Eugenia L. Siegler
els2006@med.cornell.edu

¹ Department of Medicine, Weill Cornell Medicine,
New York, NY, USA

² Division of Infectious Diseases, Weill Cornell Medicine,
New York, NY, USA

³ Albany Medical Center, Albany, NY, USA

⁴ Division of Geriatrics and Palliative Medicine, Weill Cornell
Medicine, 525 E. 68th Street, Box 39, New York, NY 10065,
USA

Table 2 ARV adverse effects, geriatric considerations, and drug interactions by drug class

Drug class	Medication	Adverse effects	Geriatric considerations	Drug interactions
Integrase strand transfer inhibitors (INSTI)		Generally well tolerated as a class. Reports of 4–10% of patients with CNS and/or GI side effects in some series, Bictegravir with lowest side effect profile [21]		Oral absorption reduced when co-administered with calcium, aluminum or magnesium antacids, or calcium or iron supplements. If the above medications must be used, INSTI can be given while fasting 2 h before, or in some cases, given simultaneously with food [22]
	Bictegravir	Few; <2% of patients with side effects including dyspepsia, flatulence, vomiting, abdominal pain	Not recommended with CrCl <30 mL/min Increases tubular secretion of creatinine without changing GFR, therefore may have transient (<4 week) increase in serum Cr	CYP3A4 substrate Should not be used with rifamycins, St. John's Wort, and anticonvulsants known to induce CYP3A4 [22] Inhibits OCT2 and MATE1 drug transporters; contraindicated with the antiarrhythmic dofetilide, as it will increase the concentration of antiarrhythmic Can increase concentration of metformin [20]
	Dolutegravir	CNS GI	Can cause sleep disturbances, headache, fatigue, malaise, altered mood, insomnia, nightmares Lowest risk of GI side effects [21]	CYP3A4 substrate Should not be used with rifampin, St. John's Wort, and anticonvulsants known to induce CYP3A4 [22] Inhibits OCT2 and MATE1 drug transporters; contraindicated with the antiarrhythmic dofetilide as it will increase the concentration of antiarrhythmic Can significantly increase concentration of metformin, consider dosage reduction for metformin
	Elvitegravir	GI Upset CNS	GI side effects of nausea, vomiting and diarrhea CNS fatigue, headache, sleep disturbance	Only available co-formulated with cobicistat pharmacokinetic enhancer, therefore CYP3A4 inhibition Elvitegravir is a UGT1A1 substrate [20]
	Raltegravir	GI upset CNS	Lowest CNS side effect profile. GI side effects of nausea, vomiting and diarrhea Rare reports of myopathy and rhabdomyolysis. Avoid in patients with history of myopathy Nausea, headache, diarrhea, insomnia, depression	Lowest risk of drug interactions. Not a substrate of Cytochrome P450 system. Metabolized by UGT1A1-mediated glucuronidation Co-administration of raltegravir with drug that is inducer of UGT1A1 may reduce plasma concentration of raltegravir (i.e. rifampin) Most are renally metabolized and not affected by liver dysfunction
Nucleoside reverse transcriptase inhibitors (NRTI)				

Table 2 (continued)

Drug class	Medication	Adverse effects	Geriatric considerations	Drug interactions
Tenofovir	Tenofovir	Rare lactic acidosis and hepatic failure Also treats HBV, flare-up of HBV if tenofovir discontinued	TAF with improved GFR and hip/spine bone mineral density (BMD) compared to TDF [24]	Drugs which affect P-glycoprotein and BCRP will change tenofovir concentration. Anticonvulsants: carbamazepine, oxcarbazepine, phenobarbital and phenytoin will decrease concentration of tenofovir. Rifamycins and St. John's Wort also decrease concentration of tenofovir [20]
	Alafenamide (TAF)	Headache most common side effect. < 10% of patients with abdominal pain, fatigue, malaise	For TAF, no dose adjustment is required for patients with CrCl 30ml/min or higher. When CrCl is <30 ml/min, TAF is not recommended	
Disoproxil fumarate (TDF)	Disoproxil fumarate (TDF)	Decreased GFR. Rare cases of acute renal failure and Fanconi syndrome Reduced BMD and increased risk for osteoporotic fracture [23]	For TDF, providers should dose adjust if CrCl is <50 mL/min	
	Emtricitabine (FTC)	Rare lactic acidosis and hepatic failure Also treats HBV, flare-up of HBV if emtricitabine discontinued 10–15% of patients report headache, diarrhea, nausea, fatigue, dizziness, abnormal dreams, abdominal pain, cough, rhinitis, rash	Dose adjust for GFR < 50 mL/min	
Lamivudine (3TC)	Lamivudine (3TC)	Rare lactic acidosis and hepatic failure Also treats HBV, flare-up of HBV if Lamivudine discontinued Headache, nausea, malaise, fatigue, rhinorrhea, diarrhea, and cough most common side effects	Dose adjust for CrCl < 50 mL/min	
	Abacavir (ABC)	Hypersensitivity reaction, increased risk if HLA-B5701 (General prevalence ~ 5% of population, most common in Caucasian males) [25] Cardiac risk ^a : > 2-fold risk of CVD reported in case series [26]	Cardiac risk ^a Hypersensitivity reaction	
Zidovudine	Zidovudine	Anemia, neutropenia Fatigue Lipodystrophy	Rarely used	

Table 2 (continued)

Drug class	Medication	Adverse effects	Geriatric considerations	Drug interactions
Non-nucleoside reverse transcriptase inhibitors (NNRTI)		CNS effects and rash most common		Generally act as CYP450 3A4 inducers, therefore interact with Rifampin, azoles, AEDs, statins, midazolam, ergotamines and other HIV medications when used concurrently [20] Caution dosing antiplatelet agents i.e.: clopidogrel, prasugrel, ticagrelor with NNRTIs. Ticagrelor should not be given with any NNRTI
	Efavirenz	CNS effects, suicidality, rash	Mental health, specifically suicidality increased in trial data of efavirenz as initial regimen [27] Absorption improved when taken with a full meal	Inhibits CYP450 2C9, 2C19, and 3A4 Significant decreases in concentration of methadone, voriconazole, rifabutin Reduces concentration of clopidogrel metabolite [28], consider prasugrel for platelet inhibition
	Rilpivirine	Poor absorption with proton pump inhibitors (PPIs)	Avoid if VL > 100 k copies/mL or CD4 < 200 cells/mm ³ Needs to be taken with food	Substrate of CYP450 system, low risk of drug interactions Concurrent PPIs contraindicated Can be given with clopidogrel without dose adjustment
	Nevirapine	Hepatotoxicity Hypersensitivity reaction	No longer used commonly	Can be given with clopidogrel without dose adjustment
	Doravirine	Generally well tolerated. Nausea, dizziness, headache, fatigue, diarrhea, abdominal pain, abnormal dreams possible		Cannot be given with strong CYP3A4 inducers; anticonvulsants, enzalutamide (androgen receptor inhibitor), rifampin, St. John's wort
Protease inhibitors (PI)	Etravirine	Rash, rare cases of SJS. Fat redistribution Peripheral neuropathy		Inducer of CYP3A and inhibitor of CYP2C9, CYP2C19 and P-glycoprotein Reduces concentration of active metabolite for clopidogrel, if platelet inhibitor needed consider prasugrel [20]
		Most common side effects in this class are GI and hyperlipidemia (HLD) Most commonly in “boosted” formulations	PIs may be “boosted” with pharmacokinetic enhancers ritonavir or cobicistat, which are potent CYP450 inhibitors	Ritonavir and cobicistat are CYP450 3A4 inhibitors See Table 3 for more detailed medication interactions
				Warfarin can be used, INR may be decreased—requires close monitoring Caution with concurrent use of Direct-Acting Oral Anticoagulants (DOACs)

Table 2 (continued)

Drug class	Medication	Adverse effects	Geriatric considerations	Drug interactions
Fusion inhibitors	Darunavir	Skin rash Diarrhea Nausea/vomiting Headache	Dosed alone or “boosted” Often used if high resistance or in very treatment-experienced patients	See Table 3 about “boosting” agents Darunavir contains a sulfonamide moiety, use with caution in patients with sulfa allergy
	Atazanavir	Increased indirect bilirubin GI upset Kidney stones	“Boosted” with ritonavir or cobicistat	See Table III about “boosting” agents
	Lopinavir	Diarrhea HLD	“Boosted” with ritonavir	See Table III about “boosting” agents
	Enfuvirtide Injection	Injection site reaction	Rarely used May be difficult to inject into subcutaneous tissue in thin/frail individuals	
CCR5 antagonist	Maraviroc	Hepatotoxicity, in some cases preceded by allergic/IgE reaction		CYP450 substrate, therefore reduce dose when given with potent CYP3A4 inhibitor, increase dose when given with CYP3A4 inducer