CLINICAL GUIDELINES PROGRAM
NEW YORK STATE DEPARTMENT OF HEALTH AIDS INSTITUTE | HIV • HCV • STIs • SUBSTANCE USE • LGBTQ+ HEALTH

Perioperative Care in Adults With HIV

Updates, Authorship, and Related Resources

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Lead author	Sangyoon Jason Shin, DO
Writing group	Rona M. Vail, MD, AAHIVS; Sanjiv S. Shah, MD, MPH, AAHIVM, AAHIV; Steven M. Fine, MD, PhD; Joseph P. McGowan, MD, FACP, FIDSA; Samuel T. Merrick, MD; Asa E. Radix, MD, MPH, PhD, FACP, AAHIVS; Jessica Rodrigues, MPH, MD; Christopher J. Hoffmann, MD, MPH; Brianna L. Norton, DO, MPH; Charles J. Gonzalez, MD
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Purpose of This Guideline

This guideline was developed by the New York State Department of Health AIDS Institute (NYSDOH AI) to assist clinicians in perioperative care management for adults with HIV, which is largely the same as for adults without HIV. The guideline focuses on concerns specific to patients with HIV. The goals of this guideline are to:

- Make clear that HIV is not a contraindication to surgery.
- Advise that HIV does not increase surgical risk in virally suppressed patients and that HIV transmission to the surgical team is eliminated in virally suppressed patients.
- Provide guidance for managing risks of elective surgery in patients who are not virally suppressed.
- Emphasize that interruptions in antiretroviral therapy and opportunistic infection prophylaxis or treatment should be avoided.

The guideline is intended to supplement, not replace, routinely used perioperative protocols that cover stabilization of active medical conditions and risk stratification.

Note on "experienced" HIV care providers: The NYSDOH AI Clinical Guidelines Program defines an "experienced HIV care provider" as a practitioner who has been accorded HIV Specialist status by the American Academy of HIV Medicine. Nurse practitioners (NPs) and licensed midwives who provide clinical care to individuals with HIV in collaboration with a physician may be considered experienced HIV care providers if all other practice agreements are met; NPs with more than 3,600 hours of qualifying experience do not require collaboration with a physician (8 NYCRR 79-5:1; 10 NYCRR 85.36; 8 NYCRR 139-6900). Physician assistants who provide clinical care to individuals with HIV under the supervision of an HIV Specialist physician may also be considered experienced HIV care providers (10 NYCRR 94.2).

HIV-Specific Perioperative Considerations

☑ RECOMMENDATIONS

Emergency and Urgent Surgery

- Clinicians should not delay an emergency or urgent surgical procedure to determine a patient's CD4 count or HIV viral load. (A*)

Elective Surgery: Determine HIV Clinical Status

- As part of the standard preoperative evaluation for patients with HIV, clinicians should review the medical record for results of an HIV viral load test within the previous 6 months and CD4 count within the previous 12 months; if one or both results are not available, the clinician should order laboratory testing to evaluate the patient's HIV clinical status. (A3)
- If a patient is taking ART and has an HIV viral load <200 copies/mL and a CD4 count >200 cells/mm^3, the clinician should proceed with the surgical plan as with a patient who does not have HIV [a]. (A2)
- If a patient's HIV clinical status suggests an increased risk of surgical complications (e.g., unsuppressed HIV viral load or low CD4 count), the clinician should consult with an experienced HIV care provider to formulate a plan to optimize the patient's HIV treatment and to estimate the likely timeline for improvement in HIV clinical status. (A3)
  - Clinicians should refer patients who are not taking ART to an experienced HIV care provider who can promptly initiate ART. (A1)
  - If optimized ART is likely to improve the patient's clinical status within an acceptable amount of time, then the clinician should inform the patient of the benefits and any potential risks of delaying elective surgery and engage the patient in shared decision-making regarding when to proceed. (A3)
  - If the patient chooses not to pursue a change in HIV treatment or the benefit of surgery will be compromised by waiting, the clinician should explain the potential surgical risks associated with immunosuppression and uncontrolled viremia and engage the patient in shared decision-making regarding when to proceed with elective surgery. (A3)

Continue HIV Medications

- Clinicians should consult with an experienced HIV care provider before interrupting a patient's ART during the pre- and postoperative period if interruption cannot be avoided. (A1)
- Clinicians should consult with an experienced HIV care provider before interrupting a patient's treatment or prophylaxis for OIs if interruption cannot be avoided. (A3)

Evaluate for Potential Drug-Drug Interactions

- Clinicians should evaluate potential drug-drug interactions with any surgery-associated medications, with particular attention to drug-drug interactions with PIs, NNRTIs, and boosters such as ritonavir or cobicistat. (A*)

Abbreviations: ART, antiretroviral therapy; NNRTI, non-nucleoside reverse transcriptase inhibitor; OI, opportunistic infection; PI, protease inhibitor.

Note:

a. Patients who are taking ART and have had an undetectable HIV viral load for many years may have incomplete immune reconstitution and a low CD4 count. In this circumstance, delaying surgery is unlikely to lead to CD4 count recovery.

→ KEY POINTS

- The risk of HIV transmission from patient to healthcare worker during surgical procedures is extremely low; from 1985 to 1999, 2 surgical technicians and no surgeons reported occupational HIV transmission to the Centers for Disease Control and Prevention, with none since 1999 [Joyce, et al. 2015].
- When performing surgery on patients with HIV, clinicians should employ standard universal surgical precautions to prevent exposure to blood and bodily fluids.
  - If exposure to the blood or body fluids of a patient with HIV occurs, follow standard institutional protocols and consult the NYSDOH AI guideline PEP to Prevent HIV Infection.

Emergency and Urgent Surgery

Consistent with operative standards of care, emergency and urgent surgeries should not be delayed in patients with HIV for preoperative evaluation and risk stratification, including CD4 count and HIV viral load testing. CD4 count testing can often take many days to complete.

Elective Surgery: Determine HIV Clinical Status

Preoperative evaluation: All standard preoperative assessments should be performed in patients with HIV, including cardiovascular and pulmonary evaluations such as the Revised Cardiac Risk Index (RCRI) and the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) Surgical Risk Calculator scores. Individuals with HIV tend to have earlier and more comorbidities than those without HIV, including coronary artery disease, thromboembolic events, and pulmonary complications. As with all patients, a detailed assessment of social support, housing, and food security is required to determine the level of assistance needed for optimal postoperative recovery.

In patients with HIV, clinicians should review the most recent CD4 cell count and HIV viral load test results as part of the preoperative evaluation. If recent test results (6 months for HIV viral load; 12 months for CD4 count) are available in the patient's medical records, retesting before surgery is unnecessary. For most individuals taking ART, the current recommendation is to perform CD4 count testing every 12 months if a patient's CD4 count is ≤350 cells/mm^3 and HIV viral load testing at least every 6 months. In those with viral suppression and a CD4 count >350 cells/mm^3, CD4 count monitoring is optional.

If records indicate that a patient has undetectable HIV RNA but has not had recent CD4 count testing, a CD4 count can be ordered, though it is not necessary and should not delay surgery. If no records are available, preoperative CD4 count and HIV viral load tests should be ordered. Other laboratory test results to consider for patients with HIV include complete blood count with differential and basic metabolic panel [Smetana and Macpherson 2003].

→ KEY POINT

- In individuals with controlled HIV and higher CD4 counts, the risk of surgical complications and postoperative mortality is approximately the same as in individuals without HIV.

Risk factors for surgical complications: In general, in patients with HIV, the combination of a low CD4 count and an uncontrolled viral load is associated with an increased risk of postoperative mortality and complications. If surgery is elective and the patient has a viral load level ≥200 copies/mL or CD4 count ≤200 cells/mm^3, clinicians should consult with the patient's primary care provider or an experienced HIV care provider.

Several studies have shown that a diagnosis of AIDS (CD4 count ≤200 cells/mm^3) is associated with increased postoperative mortality [Sandler, et al. 2019; Gahagan, et al. 2016; King, et al. 2015; Naziri, et al. 2015; Horberg, et al. 2006]. This finding was consistent across multiple sites for emergency general surgery [Sandler, et al. 2019], total hip arthroplasty [Naziri, et al. 2015], and all types of surgery at a Kaiser Permanente Medical Care Program in Northern California [Horberg, et al. 2006].

One study found a slightly higher mortality rate among people with controlled HIV (CD4 count >200 cells/mm^3) compared to those without HIV [King, et al. 2015], but 2 studies found no increased mortality [Sandler, et al. 2019; Gahagan, et al. 2016]. In a systematic review and pooled analysis of outcomes after cardiac surgery, investigators found that mortality in patients with HIV was similar to that in those without HIV (odds ratio 0.89, 95% confidence interval 0.72-1.12, P = 0.32) [Dominici and Chello 2020]. Evidence is mixed on an association between low CD4 count and postoperative complications, such as infections and poor wound healing [Zhao, et al. 2021; Lin, et al. 2020; Sandler, et al. 2019; Sharma, et al. 2018; Guild, et al. 2012; Cacala, et al. 2006; Horberg, et al. 2006; Tran, et al. 2000]. One study found that a viral load >30,000 copies/mL, but not CD4 count, was associated with an increased risk of surgical complications [Horberg, et al. 2006].

The results of these studies can be difficult to interpret because the studies were conducted during different periods, and most did not evaluate the effect of HIV RNA level. However, the evidence points to an increased risk of surgical complications in patients with HIV who have low CD4 counts, almost certainly in combination with viremia and AIDS-related comorbidities.

Not all patients with HIV RNA levels ≥200 copies/mL and CD4 count ≤200 cells/mm^3 are at increased risk of surgical complications. Some patients may have stable, low-level viremia and additional time on ART or changing the ART regimen is unlikely to reduce the viral load or change clinical stability. For these patients, it is reasonable for surgery to proceed. Input from the patient's primary care doctor or an experienced HIV care provider is essential to help guide this decision. Other

patients who are taking ART may have an undetectable HIV viral load for many years but have incomplete immune reconstitution, and therefore low CD4 counts. In this circumstance, delaying surgery is unlikely to lead to CD4 count recovery.

If initiating or changing ART has the potential to reduce the risk of surgical complications, clinicians should engage the patient in shared decision-making regarding the risks and benefits of delaying elective surgery long enough to initiate or adjust ART. The decision to delay surgery involves nuance and a balance of risks and benefits for the individual patient. Factors to consider include the patient's clinical stability defined by the American Society of Anesthesiologists Physical Status Classification system, purpose of surgery (emergency vs. elective), risk of delaying surgical intervention, likelihood that the patient will return for surgery, and likelihood that the patient's clinical status will improve during the delay.

If patients are not taking ART, clinicians should refer them to an HIV care provider who can initiate ART. If a patient has a high viral load and low CD4 count and chooses not to take or change ART, clinicians should explain the potential risk of surgical complications and engage the patient in a discussion of the risks and benefits of planned elective surgery.

Perioperative antibiotic prophylaxis: As noted above, evidence is mixed regarding an association between lower CD4 count and postoperative infections. Some studies found a positive association in multiple types of surgeries [Sandler, et al. 2019; Liu, et al. 2012; Zhang, et al. 2012; Tran, et al. 2000] and orthopedic traumas [Zhao, et al. 2021; Guild, et al. 2012], while others found no association across multiple types of surgeries [Cacala, et al. 2006], including total hip arthroplasties [Lin, et al. 2020]. One study found that higher viral loads, but not low CD4 cell counts, were associated with postoperative complications, including infections across multiple types of surgery [Horberg, et al. 2006]. Taken together, the evidence suggests that use of pre-operative antibiotic prophylaxis is reasonable in patients with low CD4 cell counts or high viral loads to decrease the chance of postoperative surgical site infections and sepsis.

Continue HIV Medications

ART and OI prophylaxis should be continued throughout the perioperative period, especially in patients with HIV/hepatitis B virus (HBV) coinfection in whom cessation of ART can lead to an HBV flare [Perrillo 2001]. If patients have difficulty swallowing or nasogastric tubes, clinicians can offer equivalent doses of ART in liquid formulations or pediatric pill sizes and advise patients which ART medications can be crushed. For all forms of ART (oral, injection, infusion), the timing of elective surgery should be coordinated with the timing of ART administration to avoid missed doses.

If a patient cannot eat or drink due to the surgical procedure and ART interruption is necessary, all medications in the regimen should be held. If a patient is taking prophylaxis for HIV-related OIs, clinicians should consult an infectious disease specialist if medication interruption or dosing adjustments are required.

Evaluate for Drug-Drug Interactions With Antiretroviral Medications

There is increased potential for drug-drug interactions in patients taking ART due to cytochrome P450 interactions with PIs, NNRTIs, and regimens boosted with ritonavir or cobicistat. Table 1, below, lists common perioperative medications that may interact with ART. It is essential to check up-to-date resources for potential interactions (see Resources: HIV Drug-Drug Interactions, below) or consult with an experienced HIV care provider. If there is an unavoidable drug-drug interaction, clinicians should consult an experienced HIV care provider before surgery to plan medication management and dosing.

Table 1: Potential Drug-Drug Interactions Between Medications Commonly Used in Perioperative Management and Antiretroviral Agents (also see drug package inserts)

Perioperative Medication or Class	Antiretroviral Medication or Class
Anesthetics [a]	
Fentanyl	• **All boosted PIs [b]:** Increased fentanyl blood levels possible due to strong inhibition of CYP3A4 with cobicistat and ritonavir. Monitor for fentanyl-related adverse effects, including potentially fatal respiratory depression. • **Bictegravir, cabotegravir (oral or injectable), dolutegravir, raltegravir:** No change in fentanyl level expected. No dose adjustment required.

Table 1: Potential Drug-Drug Interactions Between Medications Commonly Used in Perioperative Management and Antiretroviral Agents (also see drug package inserts)	
Perioperative Medication or Class	**Antiretroviral Medication or Class**
	• **Elvitegravir, boosted:** Increased fentanyl blood levels possible due to strong inhibition of CYP3A4 with cobicistat and ritonavir. Monitor for fentanyl efficacy and adverse effects, including potentially fatal respiratory depression. • **Lenacapavir:** Increased fentanyl blood levels possible due to moderate inhibition of CYP3A4. Consider fentanyl dose reduction until the effects of the combination are known; monitor for respiratory depression and sedation.
Lidocaine	• **Atazanavir, unboosted:** Possible increased lidocaine levels due to CYP3A4 inhibition from PI. Consider alternative antiretroviral or antiarrhythmic agents. If coadministered, monitor for antiarrhythmic-related adverse effects. • **All boosted PIs [b]:** Possible increased lidocaine levels due to CYP3A4 inhibition from cobicistat and ritonavir. Do not coadminister. • **Bictegravir, cabotegravir (oral or injectable), dolutegravir, raltegravir:** No interaction expected with lidocaine. No dose adjustment needed. • **Elvitegravir/cobicistat:** Possible increased lidocaine levels due to CYP3A4 inhibition from cobicistat. Do not coadminister. • **Lenacapavir:** Possible increase in serum concentrations of the active metabolite(s) of lidocaine (systemic) due to moderate CYP3A4 inhibition; specifically, concentrations of monoethylglycinexylidide may be increased. Magnitude and clinical significance of this interaction appear greater with oral lidocaine administration compared with other administration routes (i.e., intravenous, intramuscular, inhaled); monitor for increased lidocaine toxicities when oral lidocaine is combined with moderate CYP3A4 inhibitors.
Paralytics and Reversal Agents [c]	
Rocuronium	• **Boosted PIs [b]:** Possible increase in rocuronium bromide levels due to CYP3A4 inhibition from ritonavir and cobicistat. Possible increased risk of myopathy. • **Elvitegravir, boosted:** Possible increase in rocuronium bromide levels due to CYP3A4 inhibition from ritonavir and cobicistat. Possible increased risk of myopathy. • **Lenacapavir:** No interaction expected. No dose adjustment required.
Sedatives	
Haloperidol	See NYSDOH AI resource Drug-Drug Interaction Guide: From HIV Prevention to Treatment > Antipsychotics.
Midazolam	• **All boosted PIs [b]:** Increased midazolam levels expected due to CYP3A4 inhibition. – **Oral midazolam:** Contraindicated; do not coadminister with protease inhibitors. – **Parenteral midazolam:** Can be used in a setting with monitoring and appropriate medical management given possible respiratory depression or prolonged sedation. Consider dose reduction, especially if more than a single dose of midazolam is administered. • **Efavirenz:** Increased or decrease levels of midazolam possible due to effects of efavirenz on CYP3A4. Monitor for therapeutic effectiveness and toxicity of midazolam. • **Etravirine:** Decreased levels of midazolam (AUC by 31%) due to CYP3A4 induction from etravirine. Monitor for therapeutic effectiveness of midazolam. • **Rilpivirine (oral or injectable), doravirine:** No interaction expected. No dose adjustment required. • **Bictegravir, cabotegravir (oral or injectable), raltegravir:** No interaction expected. No dose adjustment required.

Table 1: Potential Drug-Drug Interactions Between Medications Commonly Used in Perioperative Management and Antiretroviral Agents (also see drug package inserts)	
Perioperative Medication or Class	**Antiretroviral Medication or Class**
	• **Elvitegravir/cobicistat:** Increased midazolam levels expected due to CYP3A4 inhibition. – **Oral midazolam:** Contraindicated; do not coadminister oral midazolam and elvitegravir/cobicistat. – **Parenteral midazolam:** Can be used in a setting with monitoring and appropriate medical management given possible respiratory depression or prolonged sedation. Consider dose reduction, especially if more than a single dose of midazolam is administered. • **Lenacapavir:** Moderate inhibition of CYP3A4 and P-gP potentially increases midazolam levels. Use with caution; monitor for excess sedation.
Olanzapine	• **Atazanavir, unboosted; PIs [b] boosted with cobicistat:** No interaction expected. No dose adjustment required. • **PIs boosted with ritonavir:** Decreased olanzapine levels due to CYP450 induction from olanzapine. Monitor for therapeutic effectiveness of olanzapine. • **Doravirine, etravirine, rilpivirine (oral or injectable):** No interaction expected. No dose adjustment required. • **Efavirenz:** Possible reduced olanzapine levels due to CYP3A4 induction from efavirenz. Monitor for therapeutic effectiveness of olanzapine. • **Bictegravir, cabotegravir (oral or injectable), dolutegravir, elvitegravir/cobicistat, raltegravir:** No interaction expected. No dose adjustment required. • **Lenacapavir:** No interaction expected. No dose adjustment required.
Miscellaneous short-acting antipsychotics (risperidone, ziprasidone, quetiapine)	• **All boosted PIs [b]:** Increased antipsychotic levels possible due to CYP3A4 inhibition from ritonavir or cobicistat. – Use lowest initial antipsychotic dose. Monitor for adverse events, including QTc prolongation. – **Quetiapine:** Maximum initial dose of quetiapine 1/6 of standard initial dose. • **Doravirine, rilpivirine (oral or injectable):** No interaction expected. No dose adjustment required. • **Efavirenz, etravirine, nevirapine:** Possible decreased antipsychotic levels due to induction from non-nucleoside reverse transcriptase inhibitors. Monitor for therapeutic effectiveness of antipsychotic. • **Bictegravir, cabotegravir (oral or injectable), raltegravir:** No interaction expected. No dose adjustment required. • **Elvitegravir/cobicistat:** Increased antipsychotic levels expected due to CYP3A4 inhibition with cobicistat. – Use lowest initial antipsychotic dose. Monitor for adverse events, including QTc prolongation. – **Quetiapine:** Maximum initial dose of quetiapine 1/6 of standard initial dose. • **Lenacapavir:** Increased serum concentration of **quetiapine** possible due to moderate CYP3A4 inhibition; monitor for increased quetiapine effects and toxicities, including QTc prolongation.
Miscellaneous, Other	
Ondansetron	No interactions expected. No dose adjustment required.
Acid-reducing agents	See NYSDOH AI resource Drug-Drug Interaction Guide: From HIV Prevention to Treatment > Acid-Reducing Agents.

Table 1: Potential Drug-Drug Interactions Between Medications Commonly Used in Perioperative Management and Antiretroviral Agents (also see drug package inserts)	
Perioperative Medication or Class	**Antiretroviral Medication or Class**
Anticoagulants	See NYSDOH AI resource Drug-Drug Interaction Guide: From HIV Prevention to Treatment > Anticoagulants.
Non-opioid analgesics	See NYSDOH AI resource Drug-Drug Interaction Guide: From HIV Prevention to Treatment > Nonopioid Pain Medications for potential interactions between NSAIDs and tenofovir disoproxil fumarate.
Opioid analgesics	See NYSDOH AI resource Drug-Drug Interaction Guide: From HIV Prevention to Treatment > Opioid Analgesics and Tramadol.

Abbreviations: ART, antiretroviral therapy; AUC, area under the curve; CYP3A4, cytochrome P450 3A4; CYP450, cytochrome P450; FDA, U.S. Food and Drug Administration; NSAID, nonsteroidal anti-inflammatory drug; P-gP, P-glycoprotein; PI, protease inhibitor; QTc, corrected QT interval.

Notes:

a. No drug-drug interactions are expected between propofol or sevoflurane and most antiretroviral (ARV) medications. Because propofol and sevoflurane are associated with QT prolongation risk, there is potential (although unlikely) risk in coadministration with ARV agents that may also be associated with QT prolongation: atazanavir (boosted and unboosted), ritonavir-boosted lopinavir, rilpivirine, and fostemsavir. See prescribing information for individual agents.
b. Currently available FDA-approved PIs: Atazanavir, darunavir, fosamprenavir, ritonavir, saquinavir, tipranavir, ritonavir-boosted lopinavir.
c. No drug-drug interactions are expected between succinylcholine or sugammadex and ARV medications.

◊ RESOURCES

- NYSDOH AI resource Drug-Drug Interaction Guide: From HIV Prevention to Treatment
- University of Liverpool HIV Drug Interactions
- Prescribers' Digital Reference
- U.S. Department of Health and Human Services Guidelines for the Use of Antiretroviral Agents in Adults and Adolescents Living With HIV > Drug-Drug Interactions

Manage Postoperative Care

There is a greater risk of venous thrombosis in patients with HIV than those without HIV [Bala, et al. 2016; Malek, et al. 2011; Shen and Frenkel 2004]. Thus, it is essential to mobilize patients with HIV as soon as medically feasible after surgery; for patients at moderate risk of venous thrombosis, mechanical/pharmacologic prophylaxis can be initiated [Gould, et al. 2012]. People with a long history of HIV, low CD4 count, or exposure to boosted regimens and glucocorticoids are at increased risk of hypoadrenalism, which the stress of surgery can unmask [Makaram, et al. 2018]. This possibility should be considered in assessing postoperative hypotension.

In patients with HIV and postoperative fever, common causes of fever, including urinary tract infections, pneumonia, venous thromboembolism, wound infections, or *Clostridioides difficile* if antibiotics were administered, should be considered before HIV-related causes. If the patient has a CD4 count ≤200 cells/mm^3, clinicians should consult an infectious disease specialist and consider OIs.

If ART or OI prophylaxis is discontinued, clinicians should ensure the patient restarts the medication(s) as soon as possible.

All Recommendations

☑ ALL RECOMMENDATIONS: PERIOPERATIVE CARE IN ADULTS WITH HIV

Emergency and Urgent Surgery

- Clinicians should not delay an emergency or urgent surgical procedure to determine a patient's CD4 count or HIV viral load. (A*)

Elective Surgery: Determine HIV Clinical Status

- As part of the standard preoperative evaluation for patients with HIV, clinicians should review the medical record for results of an HIV viral load test within the previous 6 months and CD4 count within the previous 12 months; if one or both results are not available, the clinician should order laboratory testing to evaluate the patient's HIV clinical status. (A3)
- If a patient is taking ART and has an HIV viral load <200 copies/mL and a CD4 count >200 cells/mm^3, the clinician should proceed with the surgical plan as with a patient who does not have HIV [a]. (A2)
- If a patient's HIV clinical status suggests an increased risk of surgical complications (e.g., unsuppressed HIV viral load or low CD4 count), the clinician should consult with an experienced HIV care provider to formulate a plan to optimize the patient's HIV treatment and to estimate the likely timeline for improvement in HIV clinical status. (A3)
  - Clinicians should refer patients who are not taking ART to an experienced HIV care provider who can promptly initiate ART. (A1)
  - If optimized ART is likely to improve the patient's clinical status within an acceptable amount of time, then the clinician should inform the patient of the benefits and any potential risks of delaying elective surgery and engage the patient in shared decision-making regarding when to proceed. (A3)
  - If the patient chooses not to pursue a change in HIV treatment or the benefit of surgery will be compromised by waiting, the clinician should explain the potential surgical risks associated with immunosuppression and uncontrolled viremia and engage the patient in shared decision-making regarding when to proceed with elective surgery. (A3)

Continue HIV Medications

- Clinicians should consult with an experienced HIV care provider before interrupting a patient's ART during the pre- and postoperative period if interruption cannot be avoided. (A1)
- Clinicians should consult with an experienced HIV care provider before interrupting a patient's treatment or prophylaxis for OIs if interruption cannot be avoided. (A3)

Evaluate for Potential Drug-Drug Interactions

- Clinicians should evaluate potential drug-drug interactions with any surgery-associated medications, with particular attention to drug-drug interactions with PIs, NNRTIs, and boosters such as ritonavir or cobicistat. (A*)

Abbreviations: ART, antiretroviral therapy; NNRTI, non-nucleoside reverse transcriptase inhibitor; OI, opportunistic infection; PI, protease inhibitor.

Note:

a. Patients who are taking ART and have had an undetectable HIV viral load for many years may have incomplete immune reconstitution and a low CD4 count. In this circumstance, delaying surgery is unlikely to lead to CD4 count recovery.

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Supplement: Guideline Development and Recommendation Ratings

Table S1: Guideline Development: New York State Department of Health AIDS Institute Clinical Guidelines Program	
Developer	New York State Department of Health AIDS Institute (NYSDOH AI) Clinical Guidelines Program
Funding source	NYSDOH AI
Program manager	Clinical Guidelines Program, Johns Hopkins University School of Medicine, Division of Infectious Diseases. See Program Leadership and Staff.
Mission	To produce and disseminate evidence-based, state-of-the-art clinical practice guidelines that establish uniform standards of care for practitioners who provide prevention or treatment of HIV, viral hepatitis, other sexually transmitted infections, and substance use disorders for adults throughout New York State in the wide array of settings in which those services are delivered.
Expert committees	The NYSDOH AI Medical Director invites and appoints committees of clinical and public health experts from throughout New York State to ensure that the guidelines are practical, immediately applicable, and meet the needs of care providers and stakeholders in all major regions of New York State, all relevant clinical practice settings, key New York State agencies, and community service organizations.
Committee structure	• Leadership: AI-appointed chair, vice chair(s), chair emeritus, clinical specialist(s), JHU Guidelines Program Director, AI Medical Director, AI Clinical Consultant, AVAC community advisor • Contributing members • Guideline writing groups: Lead author, coauthors if applicable, and all committee leaders
Disclosure and management of conflicts of interest	• Annual disclosure of financial relationships with commercial entities for the 12 months prior and upcoming is required of all individuals who work with the guidelines program, and includes disclosure for partners or spouses and primary professional affiliation. • The NYSDOH AI assesses all reported financial relationships to determine the potential for undue influence on guideline recommendations and, when indicated, denies participation in the program or formulates a plan to manage potential conflicts. Disclosures are listed for each committee member.
Evidence collection and review	• Literature search and review strategy is defined by the guideline lead author based on the defined scope of a new guideline or update. • A comprehensive literature search and review is conducted for a new guideline or an extensive update using PubMed, other pertinent databases of peer-reviewed literature, and relevant conference abstracts to establish the evidence base for guideline recommendations. • A targeted search and review to identify recently published evidence is conducted for guidelines published within the previous 3 years. • Title, abstract, and article reviews are performed by the lead author. The JHU editorial team collates evidence and creates and maintains an evidence table for each guideline.
Recommendation development	• The lead author drafts recommendations to address the defined scope of the guideline based on available published data. • Writing group members review the draft recommendations and evidence and deliberate to revise, refine, and reach consensus on all recommendations. • When published data are not available, support for a recommendation may be based on the committee's expert opinion. • The writing group assigns a 2-part rating to each recommendation to indicate the strength of the recommendation and quality of the supporting evidence. The group reviews the evidence, deliberates, and may revise recommendations when required to reach consensus.

Table S1: Guideline Development: New York State Department of Health AIDS Institute Clinical Guidelines Program	
Review and approval process	• Following writing group approval, draft guidelines are reviewed by all contributors, program liaisons, and a volunteer reviewer from the AI Community Advisory Committee. • Recommendations must be approved by two-thirds of the full committee. If necessary to achieve consensus, the full committee is invited to deliberate, review the evidence, and revise recommendations. • Final approval by the committee chair and the NYSDOH AI Medical Director is required for publication.
External reviews	• External review of each guideline is invited at the developer's discretion. • External reviewers recognized for their experience and expertise review guidelines for accuracy, balance, clarity, and practicality and provide feedback.
Update process	• JHU editorial staff ensure that each guideline is reviewed and determined to be current upon the 3-year anniversary of publication; guidelines that provide clinical recommendations in rapidly changing areas of practice may be reviewed annually. Published literature is surveilled to identify new evidence that may prompt changes to existing recommendations or development of new recommendations. • If changes in the standard of care, newly published studies, new drug approval, new drug-related warning, or a public health emergency indicate the need for immediate change to published guidelines, committee leadership will make recommendations and immediate updates and will invite full committee review as indicated.

Table S2: Recommendation Ratings and Definitions		
Strength	**Quality of Evidence**	
A: Strong B: Moderate C: Optional	1	Based on published results of at least 1 randomized clinical trial with clinical outcomes or validated laboratory endpoints.
	*	Based on either a self-evident conclusion; conclusive, published, in vitro data; or well-established practice that cannot be tested because ethics would preclude a clinical trial.
	2	Based on published results of at least 1 well-designed, nonrandomized clinical trial or observational cohort study with long-term clinical outcomes.
	2†	Extrapolated from published results of well-designed studies (including nonrandomized clinical trials) conducted in populations other than those specifically addressed by a recommendation. The source(s) of the extrapolated evidence and the rationale for the extrapolation are provided in the guideline text. One example would be results of studies conducted predominantly in a subpopulation (e.g., one gender) that the committee determines to be generalizable to the population under consideration in the guideline.
	3	Based on committee expert opinion, with rationale provided in the guideline text.