The ART of Managing Drug-Drug Interactions in Patients with HIV

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Presentation Objectives

• Describe the HIV life cycle and how antiretroviral medications work to suppress viral replication

• Identify drug-drug interactions with common antiretroviral medications

• Recognize appropriate management strategies for drug-drug interactions in HIV patients
Presentation Abbreviations

- ART – Antiretroviral Therapy
- AUC – Area under the curve
- CD4 – Cluster of differentiation 4
- CCR5 – C-C chemokine receptor 5
- CXCR4 – C-X-C chemokine receptor 4
- DHHS – Department of Health and Human Services
- DVT – Deep vein thrombosis
- H2RAs – Histamine-2 Receptor Antagonist
- INSTIs – Integrase Inhibitors
- mRNA – messenger RNA
- NNRTIs – Non-Nucleoside Reverse Transcriptase Inhibitors
- NRTIs – Nucleoside Reverse Transcriptase Inhibitors
- PIs – Protease Inhibitors
- P-gp – P-glycoprotein
- PPIs – Proton Pump Inhibitors
- vDNA – viral DNA
- vRNA – viral RNA
- RT – reverse transcriptase
HIV Life Cycle – Fusion and Entry

Extracellular

Intracellular

CD4

CCR5 or CXCR4
Current Antiretroviral Medications

**Fusion Inhibitor (1)**
- Enfuvirtide (T-20)

**CCR-5 Inhibitors (1)**
- Maraviroc (MVC)

![Diagram showing the interaction of CD4, CCR5 or CXCR4, and Extracellular and Intracellular environments.](slide-5)
HIV Life Cycle – Transcription and Integration

- HIV RT
- vRNA
- vDNA
- Host DNA
- Integrase
- Nucleus
HIV Life Cycle – Transcription and Integration

- vRNA
- HIV RT
- vDNA
- NRTIs (7)
  - Abacavir (ABC)
  - Didanosine (ddI)
  - Emtricitabine (FTC)
  - Lamivudine (3TC)
  - Stavudine (d4T)
  - Tenofovir (TDF)
  - Zidovudine (AZT, ZDV)
- NNRTIs (5)
  - Efavirenz (EFV)
  - Etravirine (ETV)
  - Nevirapine (NVP)
  - Rilpivirine (RPV)
  - Delavirdine (DLV)
HIV Life Cycle – Transcription and Integration

**INSTIs (3)**
- Dolutegravir (DTG)
- Elvitegravir (EVG)
- Raltegravir (RAL)

**Integrase**

**Host DNA**

**vDNA**

**Nucleus**
HIV Life Cycle – Transcription and Integration

- Host DNA
- Integrase
- Integrated HIV DNA
- Nucleus

Transcription to vRNA

Translation to viral mRNA
HIV Life Cycle – Cell Exit
HIV Life Cycle – Transcription and Integration

Polyprotein

Protease

PIs (9)
- Atazanavir (ATV)
- Darunavir (DRV)
- Fosamprenavir (FPV)
- Lopinavir/r (LPV/r)
- Ritonavir (RTV)
- Tipranavir (TPV)
- Indinavir (IDV)
- Nelfinavir (NFV)
- Saquinavir (SQV)
## Current Antiretroviral Medications

<table>
<thead>
<tr>
<th>Category</th>
<th>Medications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fusion Inhibitor (1)</strong></td>
<td>Enfuvirtide (T-20)</td>
</tr>
<tr>
<td><strong>NRTIs (7)</strong></td>
<td>Abacavir (ABC), Didanosine (ddI), Emtricitabine (FTC), Lamivudine (3TC), Stavudine (d4T), Tenofovir (TDF), Zidovudine (AZT, ZDV)</td>
</tr>
<tr>
<td><strong>NNRTIs (5)</strong></td>
<td>Efavirenz (EFV), Etravirine (ETV), Nevirapine (NVP), Rilpivirine (RPV), Delavirdine (DLV)</td>
</tr>
<tr>
<td><strong>INSTIs (3)</strong></td>
<td>Dolutegravir (DTG), Elvitegravir (EVG), Raltegravir (RAL)</td>
</tr>
<tr>
<td><strong>CCR-5 Inhibitors (1)</strong></td>
<td>Maraviroc (MVC)</td>
</tr>
<tr>
<td><strong>PIs (9)</strong></td>
<td>Atazanavir (ATV), Darunavir (DRV), Fosamprenavir (FPV), Lopinavir/r (LPV/r), Ritonavir (RTV), Tipranavir (TPV), Indinavir (IDV), Nelfinavir (NFV), Saquinavir (SQV)</td>
</tr>
</tbody>
</table>
Common Antiretroviral Regimens

**NRTIs**
- Abacavir (ABC)
- Emtricitabine (FTC)
- Lamivudine (3TC)
- Tenofovir (TDF)
- Zidovudine (AZT, ZDV)

**PIs**
- Atazanavir (ATV)
- Darunavir (DRV)
- Ritonavir (RTV)

**Enhancers**
- Cobicistat (COBI)

**NNRTIs**
- Efavirenz (EFV)
- Etravirine (ETV)
- Rilpivirine (RPV)

**INSTIs**
- Dolutegravir (DTG)
- Elvitegravir (EVG)
- Raltegravir (RAL)

Backbone + One Additional Agent
## Pharmacokinetic Boosting Agents

<table>
<thead>
<tr>
<th>Cobicistat (COBI)</th>
<th>Ritonavir (RTV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- No activity against HIV</td>
<td>- HIV activity (PI)</td>
</tr>
<tr>
<td>- Less drug interactions</td>
<td>- More drug interactions</td>
</tr>
<tr>
<td>- P-gp inhibitor</td>
<td>- P-gp substrate and inhibitor</td>
</tr>
<tr>
<td>- 3A4 substrate</td>
<td>- 3A4, 2D6 – substrate</td>
</tr>
<tr>
<td>- 3A4, 2D6 – inhibitor</td>
<td>- 3A4, 2D6 – inhibitor</td>
</tr>
<tr>
<td></td>
<td>- 1A2, 2C8, 2C9, 2C19, UGT 1a1 – inducer</td>
</tr>
</tbody>
</table>
### Single-Tablet Regimens

<table>
<thead>
<tr>
<th>Drug</th>
<th>DHHS Recommendation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Genvoya</strong></td>
<td>DHHS Recommended for First-Line Use</td>
<td>elvitegravir / cobicistat / emtricitabine / tenofovir alafenamide, or EVG / COBI / FTC / TAF</td>
</tr>
<tr>
<td><strong>Stribild</strong></td>
<td>DHHS Recommended for First-Line Use</td>
<td>elvitegravir / cobicistat / emtricitabine / tenofovir DF, or EVG / COBI / FTC / TDF</td>
</tr>
<tr>
<td><strong>Trumeq</strong></td>
<td>DHHS Recommended for First-Line Use</td>
<td>dolutegravir / abacavir / lamivudine, or DTG / ABC / 3TC</td>
</tr>
<tr>
<td><strong>Atripla</strong></td>
<td>DHHS Alternative</td>
<td>efavirenz / emtricitabine / tenofovir DF, or EFV / FTC / TDF</td>
</tr>
<tr>
<td><strong>Complera</strong></td>
<td>DHHS Alternative Only if HIV RNA &lt; 100,000 C/mL and CD4 &gt; 200 Cells/μL</td>
<td>rilpivirine / emtricitabine / tenofovir DF, or RPV / FTC / TDF</td>
</tr>
<tr>
<td><strong>Odefsey</strong></td>
<td>DHHS Alternative Only if HIV RNA &lt; 100,000 C/mL and CD4 &gt; 200 Cells/μL</td>
<td>rilpivirine / emtricitabine / tenofovir alafenamide, or RPV / FTC / TAF</td>
</tr>
</tbody>
</table>

*Take with food.*
How many medication targets are there in the HIV life cycle?

A) Three

B) Four

C) Five

D) Six
Assessment of ART-related Drug Interactions
Assessment of Drug Interactions

• Tertiary drug sources interaction checkers
• University of Liverpool site
  • www.hiv-druginteractions.org
  • Only checks interactions with ART
• 2017 DHHS HIV Guidelines
  • Table 17 - Mechanisms of Antiretroviral-Associated Drug Interactions
  • Table 18 – ART Drug Interactions by class
### DHHS HIV Guidelines: Mechanisms of Antiretroviral-Associated Drug Interactions

<table>
<thead>
<tr>
<th>ARV Drugs by Drug Class</th>
<th>Mechanisms That May Affect Oral Absorption of ARV Drugs</th>
<th>Enzymes That Metabolize or are Induced or Inhibited by ARV Drugs</th>
<th>Other Mechanisms of Known Drug Interactions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Increasing Gastric pH</td>
<td>Cationic Chelation</td>
<td>P-glycoprotein</td>
</tr>
<tr>
<td>INSTIs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DTG</td>
<td></td>
<td>Concentration decreased by products containing polyvalent cations (e.g., Ca, Mg, Al, Fe, Zn)</td>
<td>Substrate</td>
</tr>
<tr>
<td>EVG</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RAL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PK Enhancers (Boosters)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COBI</td>
<td></td>
<td></td>
<td>Inhibitor</td>
</tr>
<tr>
<td>RTV</td>
<td></td>
<td></td>
<td>Substrate, inhibitor</td>
</tr>
<tr>
<td>PIs</td>
<td>Note: When PIs are coadministered with PK enhancers (boosters), the pharmacologic properties of both agents should be considered when assessing potential drug interactions.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| ATG                     | Concentration decreased | Substrate, inducer, inhibitor | 3A4          | 3A4, 2C8 (weak) | ...          | Inhibitor | OATP inhibitor |

**ARV Drugs by Drug Class:**
- DTG – Dolutegravir
- EVG – Elvitegravir
- RAL – Raltegravir
- COBI – Cobicistat
- RTV – Ritonavir
- ATV – Atazanavir

**Enzymes That Metabolize or are Induced or Inhibited by ARV Drugs:**
- CYP Substrate
- CYP Inhibitor
- CYP Inducer
- UGT1A1

**Other Mechanisms of Known Drug Interactions:**
- Inhibitor of renal transporters OCT2 and MATE

**HIV/AIDS Treatment Guidelines.** [https://aidsinfo.nih.gov/guidelines](https://aidsinfo.nih.gov/guidelines)
### DHHS HIV Guidelines: ART Drug Interactions by Class

#### Table 18a. Drug Interactions Between Protease Inhibitors and Other Drugs (Last updated October 17, 2017; last reviewed October 17, 2017) (page 2 of 17)

<table>
<thead>
<tr>
<th>Concomitant Drug</th>
<th>PI</th>
<th>Effect on PI and/or Concomitant Drug Concentrations</th>
<th>Dosing Recommendations and Clinical Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acid Reducers, continued</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPIs, continued</td>
<td>TPV/r</td>
<td>Omeprazole AUC ↓ 70%</td>
<td>Coadministration is not recommended. If coadministration is necessary, dose increases of omeprazole may be considered based on clinical response.</td>
</tr>
<tr>
<td><strong>Anticoagulants and Antiplalets</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apixaban</td>
<td>PI/c, PI/r</td>
<td>↑ apixaban expected</td>
<td>Coadministration is not recommended. Consider alternative ARV or warfarin. If coadministration is necessary, reduce apixaban dose by 50% and monitor for apixaban toxicity.</td>
</tr>
<tr>
<td>Betrixaban</td>
<td>PI/r</td>
<td>↑ or ↓ betrixaban possible</td>
<td>Coadministration is not recommended. Consider alternative ARV or warfarin.</td>
</tr>
<tr>
<td></td>
<td>ATV/c, DRV/c</td>
<td>↑ betrixaban expected</td>
<td>Coadministration is not recommended. Consider alternative ARV or warfarin.</td>
</tr>
<tr>
<td>Dabigatran</td>
<td>PI/r</td>
<td>With RTV 100 mg + dabigatran taken simultaneously: ↔ dabigatran</td>
<td>The extent of interaction of PI/r + dabigatran is unknown. Consider alternative ARV or warfarin.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dabigatran given 2 hours before RTV 100 mg: dabigatran AUC ↓ 29%</td>
<td>If coadministered, take dabigatran and PI/r simultaneously.</td>
</tr>
<tr>
<td></td>
<td>ATV/c, DRV/c</td>
<td>With COBI 150 mg: dabigatran AUC ↑ 110%–127%</td>
<td>Coadministration is not recommended. Consider alternative ARV or warfarin.</td>
</tr>
</tbody>
</table>
Management of ART-related drug interactions
Patient Case #1

• 56 year old female
• Admitted for community acquired pneumonia
• Past Medical History:
  • HIV
  • Osteopenia
• Current medications include:
  • Complera® (RPV/TDF/FTC) once daily at bedtime
  • Calcium 600mg/Vitamin D3 800IU two tablets daily
• Medicine Service orders:
  • Continue home medications
  • Pantoprazole 40mg once daily
  • Levofloxacin 500mg once daily

RPV – Rilpivirine
TDF – Tenofovir
FTC – Emtricitabine
Stomach Acid and Antiretrovirals

Boosted-Atazanavir (ATV/c or ATV/r)

- Antacids: ATV 2 hours before or 1 to 2 hours after
- H2RAs: ATV at least 10 hours after
  - Famotidine < 20mg BID
- PPIs: PPI at least 12 hours before
  - Omeprazole ≤ 20mg

Rilpivirine (RPV)

- Antacids: Give 2 hours before or 4 hours after RPV
- H2RAs: Give 12 hours before or 4 hours after RPV
- PPIs: Contraindicated
Polyvalent Cations and Antiretrovirals

- Dolutegravir (DTV)
- Elvitegravir (EVG)
- Raltegravir (RAL)

Calcium
Aluminum
Magnesium
Iron
Zinc

= Chelation
Antiretrovirals Requiring Food

- Darunavir (DRV)
- Atazanavir (ATV)
- Elvitegravir (EVG)
- Rilpirivine (RPV)
- Ritonavir (RTV) tablet

You to eat that
<table>
<thead>
<tr>
<th>Antiretroviral</th>
<th>Food Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rilpivirine (RPV)</td>
<td>400 kcal</td>
</tr>
<tr>
<td></td>
<td>13 g fat</td>
</tr>
<tr>
<td>Atazanavir (ATV)</td>
<td>350 - 721 kcal</td>
</tr>
<tr>
<td></td>
<td>8.2 - 37.3 g fat</td>
</tr>
<tr>
<td>Darunavir (DRV)</td>
<td>240 - 925 kcal</td>
</tr>
<tr>
<td></td>
<td>12 - 56 g fat</td>
</tr>
<tr>
<td>Elvitegravir/cobicistat (EVG/c)</td>
<td>373 - 800 kcal</td>
</tr>
<tr>
<td></td>
<td>20 - 50% fat</td>
</tr>
</tbody>
</table>

- **Patient Friendly Answer**
  - 400 calories
  - 10 grams fat
Patient Case #1

- 56 year old female
- Admitted for community acquired pneumonia
- Past Medical History:
  - HIV
  - Osteopenia
- Current medications include:
  - Complera® (RPV/TDF/FTC) once daily at bedtime
  - Calcium 600mg/Vitamin D3 800IU two tablets daily
- Medicine Service orders:
  - Continue home medications
  - Pantoprazole 40mg once daily
  - Levofloxacin 500mg once daily

RPV – Rilpivirine
TDF – Tenofovir
FTC – Emtricitabine
Which is an appropriate recommendation for the management of this patient?

A) Complera® (RPV/TDF/FTC) may be given at bedtime during hospital admission

B) Pantoprazole may be used for stress ulcer prophylaxis

C) Ensure spacing of antiretroviral by at least 4 hours before calcium or 2 hours after

D) A and C

E) All of the above
Patient Case #2

• 61 year old male patient
• Admitted due to right lower extremity DVT
• Patient on therapeutic enoxaparin
• Orders for transition to oral anticoagulation
• Social history:
  • Smokes 1 pack per day
• Current medication list includes
  • Lisinopril 10mg once daily
  • Tivicay® (DTG) 50mg once daily
  • Prezcobix® (DRV/r) 800mg/150mg once daily
  • Truvada® (TDF/FTC) 300mg/200mg once daily

DTG = Dolutegravir
DRV/r = Darunavir/ritonavir
TDF = Tenofovir
FTC = Emtricitabine
## Anticoagulation and Antiretrovirals

<table>
<thead>
<tr>
<th>ART</th>
<th>Apixaban</th>
<th>Dabigatran</th>
<th>Rivaroxaban</th>
<th>Warfarin</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIs (Boosted)</td>
<td>Not recommended</td>
<td>Not recommended</td>
<td>Not recommended</td>
<td>Pl/r: ↓ warfarin possible</td>
</tr>
<tr>
<td></td>
<td>↓ apixaban 50%</td>
<td>Consider alternative</td>
<td>Consider alternative</td>
<td>Monitor INR closely</td>
</tr>
<tr>
<td>COBI</td>
<td>Not recommended</td>
<td>No recommended</td>
<td>Not recommended</td>
<td>↑ or ↓ warfarin possible</td>
</tr>
<tr>
<td></td>
<td>↓ apixaban 50%</td>
<td></td>
<td></td>
<td>Monitor INR closely</td>
</tr>
<tr>
<td>NNRTIs</td>
<td>EFV, ETR, NVP: Consider alternative</td>
<td>EFV, NVP, RPV: No adjustment ETR: Consider alternative</td>
<td>EFV, ETR, NVP: Consider alternative RPV: Good</td>
<td>↑ or ↓ warfarin possible</td>
</tr>
</tbody>
</table>

**EFV** = Efavirenz  
**ETR** = Etravirine  
**NVP** = Nevirapine  
**RPV** = Rilpivirine
## Smoking Cessation and Antiretrovirals

<table>
<thead>
<tr>
<th>ART</th>
<th>Nicotine Replacement</th>
<th>Varenicline</th>
<th>Bupropion</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIs (Boosted)</td>
<td>Recommended</td>
<td>Recommended</td>
<td>↑ Bupropion dose</td>
</tr>
<tr>
<td>COBI</td>
<td>Recommended</td>
<td>Recommended</td>
<td>↑ or ↓ bupropion possible</td>
</tr>
<tr>
<td>NNRTIs</td>
<td>Recommended</td>
<td>Recommended</td>
<td>↑ Bupropion dose</td>
</tr>
</tbody>
</table>
Patient Case #2

- 61 year old male patient
- Admitted due to right lower extremity DVT
- Patient on therapeutic enoxaparin
- Orders for transition to oral anticoagulation
- Social history:
  - Smokes 1 pack per day
- Current medication list includes
  - Lisinopril 10mg once daily
  - Tivicay® (DTG) 50mg once daily
  - Prezcobix® (DRV/r) 800mg/150mg once daily
  - Truvada® (TDF/FTC) 300mg/200mg once daily

DTG = Dolutegravir
DRV/r = Darunavir/ritonavir
TDF = Tenofovir
FTC = Emtricitabine
What is your recommendation for an oral anticoagulant?

A) Apixaban 10 mg twice daily for 7 days then 5 mg twice daily

B) Dabigatran 150 mg twice daily

C) Rivaroxaban 15 mg twice daily for 21 days then 20 mg once daily

D) Warfarin 5 mg once daily adjusted per INR results

E) Warfarin 3 mg once daily adjusted per INR results
Patient Case #3

- 23 yo male patient newly diagnosed with HIV
- Patient is ready to begin antiretroviral therapy
- Past medical history:
  - Asthma
  - Seizures
- Social History
  - Denies smoking, alcohol or illicit drug use
- Current medication list includes
  - Fluticasone 110mcg 2 puffs twice daily
  - Phenobarbital 100mg twice daily
Corticosteroids and Antiretrovirals

Glucocorticoid metabolism via CYP3A4

RTV, COBI, PIs inhibit CYP3A4

Glucocorticoid accumulation

RTV – Ritonavir
COBI – Cobicistat
### Corticosteroids and Antiretrovirals

<table>
<thead>
<tr>
<th>Case</th>
<th>Age/Sex</th>
<th>Antiretrovirals</th>
<th>Corticosteroid</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>39/male</td>
<td>TDF FTC DRV/r</td>
<td>Inhaled salmeterol/fluticasone Intranasal fluticasone</td>
</tr>
<tr>
<td>2</td>
<td>12/female</td>
<td>3TC AZT LPV/r</td>
<td>Inhaled salmeterol/fluticasone</td>
</tr>
<tr>
<td>3</td>
<td>15/male</td>
<td>3TC AZT DRV/r</td>
<td>Ophthalmic dexamethasone</td>
</tr>
<tr>
<td>4</td>
<td>48/female</td>
<td>TDF FTC ATV/r</td>
<td>Injected triamcinolone epidural</td>
</tr>
</tbody>
</table>

3TC = Lamivudine  
DRV/r = Darunavir/ritonavir  
ATV/r = Atazanavir/ritonavir  
TDF = Tenofovir  
FTC = Emtricitabine  
LPV/r = Lopinavir/ritonavir  
AZT = Zidovudine
Corticosteroids and Antiretrovirals

Alternative corticosteroid options
• Beclomethasone
• Flunisolide

Alternative ART options
• NNRTIs
• INSTIs (RAL or DTG)

If benefits outweigh risks, consider dose adjustment and monitor closely

RAL = Raltegravir
DTG = Dolutegravir
# Anticonvulsants and Antiretrovirals

<table>
<thead>
<tr>
<th>Anticonvulsant</th>
<th>Antiretroviral</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbamazepine</td>
<td>PIs, RPV, EVG/c</td>
<td>Contraindicated</td>
</tr>
<tr>
<td></td>
<td>ETR, RAL</td>
<td>Avoid</td>
</tr>
<tr>
<td></td>
<td>DTG</td>
<td>Increase DTG to 50mg twice daily</td>
</tr>
<tr>
<td>Phenytoin, Phenobarbital</td>
<td>PIs, RPV, EVG/c</td>
<td>Contraindicated</td>
</tr>
<tr>
<td></td>
<td>ETR, RAL, DTG</td>
<td>Avoid</td>
</tr>
<tr>
<td>Lamotrigine, Valproic Acid</td>
<td>PIs</td>
<td>Caution</td>
</tr>
<tr>
<td></td>
<td>NNRTIs</td>
<td>Okay</td>
</tr>
</tbody>
</table>

Levetiracetam safe to use with all antiretrovirals

DTG = Dolutegravir  
RPV = Rilpivirine  
EVG/c = Elvitegravir/cobicistat  
ETR = Etravirine  
RAL = Raltegravir
Patient Case #3

• 23 yo male patient newly diagnosed with HIV
• Patient is ready to begin antiretroviral therapy
• Past medical history:
  • Asthma
  • Seizures
• Social History
  • Denies smoking, alcohol or illicit drug use
• Current medication list includes
  • Fluticasone 110mcg 2 puffs twice daily
  • Phenobarbital 100mg twice daily
What would be an appropriate recommendation for therapy?

A) Genvoya® (EVG/COBI/FTC/TDF) once daily

B) Atripla® (EFV/FTC/TDF) once daily

C) Prezcobix® (DRV/r) once daily plus Descovy® (TAF/FTC) once daily

D) Triumeq® (DTG/ABC/3TC) once daily plus Tivicay® (DTG) 50mg once daily
Antiretroviral Drug Interactions Summary

• Resources for interactions
  • DHHS Table 18

• Cobicistat and Ritonavir

• Acid Suppression
  • Atazanavir; Rilpivirine

• Food requirement
  • DAR₂E₂ you to eat that

• Warfarin – safest anticoagulant

• Corticosteroids
  • Use beclomethasone

• Levetiracetam – no drug interactions
Questions & Discussion

smith.bradley1@mayo.edu