Therapeutic Drug Monitoring: A Nursing Perspective

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Therapeutic Drug Monitoring

- Pharmacokinetics (PK) and Pharmacodynamics (PD).
- What is TDM?
- Why request TDM?
- What is the nurses role in the process?
Pharmacokinetics (PK) and Pharmacodynamics (PD):

- **Pharmacokinetics** is the study of what the body does to the drugs.
  - Drug Absorption, Distribution, Metabolism, and Elimination.

- **Pharmacodynamics** is the study of what the drugs do to the body.
  - Drug Efficacy, Toxicity and/or possible side effects.
What is TDM?

- TDM stands for Therapeutic Drug Monitoring
- Measures Drug Absorption, Distribution, and Metabolism (PK).
- Uses the blood levels to customize ARV Therapy or adjust doses for complete viral suppression with fewer side effects.
- Routinely used in most areas of medicine to achieve maximal benefit with minimal or (hopefully) no toxicity with drug therapy.
Therapeutic Range for Drug Concentration

- **Sub-Optimal Levels** are associated with low therapeutic effects with possible future resistance.
- **Therapeutic Effect** is the reduction in HIV RNA (VL), the increase of CD4 Cells and consequent decrease in Opportunistic Infections.
- **Therapeutic Range** is the Level of Drug that causes a therapeutic effect versus a toxic effect.
- **Toxic Effect** speaks for itself…
The 12 hour TDM!

- Trough Level at time zero, 12 hours after last BID Dose, or 24 hours after last OD Dose.
- Medication taken after Trough level taken.
- Blood Levels drawn every hour after for 12 hours to determine…
  - Cmax: Maximum Concentration (↑ in SE’s).
  - AUC: Under the Curve (overall Drug Exposure).
  - Cmin : Minimum or Trough concentration.
Blood levels of a Drug over time.

- **$C_{\text{max}}$** - maximum concentration (T$_{\text{max}}$ is the time $C_{\text{max}}$ happens). $C_{\text{max}}$ may relate with some side effects.

- **AUC** - area under the curve (filled area). Represents overall drug exposure.

- **t$_{\frac{1}{2}}$** - half-life (how gradually the line comes down). Time for drug concentration to fall by half. For example, it took 2 hours (on x-axis) to go from 6 (on y-axis) to 3 (on y-axis). Therefore the $t_{\frac{1}{2}}$ is about 2 hours for this drug.

- **$C_{\text{min}}$** - minimum, or trough concentration. May relate with anti-HIV effectiveness.

**Figure No. 3: Blood Levels of a Drug over Time**
# HIV-1 Pharmacokinetic Report

For research use only

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<thead>
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<th>Test Details</th>
<th>Physician Details</th>
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<td>Physician:</td>
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<td>Patient ID:</td>
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<td>Birthdate:</td>
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| Sample Comments:       |              |                   |

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<th>Time (h)</th>
<th>ATV</th>
<th>RTV</th>
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<tr>
<td>-0.5</td>
<td>480</td>
<td>104</td>
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<tr>
<td>1.0</td>
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**REFERENCE VALUES (SEE BELOW)**

<table>
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ATV Drug Product Monograph (2004); RTV Cmin & Cmax; Kalira Product Monograph; IC50 Nonv Product Monograph;
Why request TDM?

- The patient is experiencing Side Effects.
- Despite Adherence, the patient’s VL has ↑’d
- Blood Levels of some ARV’s can ↑ or ↓ due to:
  - Food Consumption (or lack of)
  - Concomitant medication (i.e.: antacids)
  - Liver and/or Renal Function/Impairment
  - Obesity or being Underweight
What is the Nurse’s Role in the TDM Process?

- Nurse as MOA
- Nurse as Phlebotomist
- Nurse as Counselor
  - Importance of Adherence
  - Side Effect Management
  - Safer Sexual Practice
  - Harm Reduction
- Nurse as EDUCATOR
Follow up after TDM

- Results reviewed by a select few at BCCFE.
  - Dr. Julio Montaner
  - Dr. Silvia Guillemi
  - Dr. Marianne Harris

- Ordering Physician receives copy with suggestions re: ARV Therapy.

- If changes are made, 2\textsuperscript{nd} TDM booked.
References Cited and Thanks…

- Positively Aware: the Journal of Test Positive Aware Network; Winter 2005 Article: What’s PK got to do with it?
- http://www.drug-monitoring.com
- Dr. Julio Montaner M.D. RCCFP – Internal Medicine
- Dr. Silvia Guillemi M.D.
- Dr. Marianne Harris M.D.CCFD
- Junine Toy BSc(Pharm) ACPR