

## Therapeutic Drug Monitoring and Peaks and Troughs

#3249

A “trough” is the lowest level of the drug in the patient’s blood stream and is measured just before the next dose of medication is scheduled to be administered.

A “peak” is the highest level of the drug in the patient’s blood stream and is generally measured about 30 minutes after a dose of medication has completely infused.

Therapeutic drug monitoring measures the level of drug in a patient’s blood stream at any given time. Drugs monitored in this way may be administered orally, or a patient may receive the medication via IV.

Peak and trough levels are generally ordered for patients receiving certain IV antibiotics. Therapeutic drug monitoring is conducted when a patient receives certain types of non-antibiotic medications. The purpose of therapeutic drug monitoring and drawing “peaks and troughs,” is to make sure the amount of medication in the patient’s blood stream is adequate for therapeutic effect, but not so high as to be toxic. For some medications, there is a very fine line between what is considered an effective dose and toxicity. Measurement of the serum drug level helps the physician determine the appropriate dose and frequency of the medication and the patient’s tolerance of the treatment. Physicians also order other tests to determine a patient’s tolerance of the treatment, such as electrolytes, BUN, creatinine, blood counts, platelets, and liver function panels.

Peak and trough levels are important information for the physician. If the peak level of the medication is too low, there may be inadequate medication to treat the patient’s illness. If the trough level remains too high, it could indicate the patient’s body may not be able to adequately metabolize the medication. This could lead to build up of the medication to toxic levels, which could cause organ damage. The physician will want to maintain a therapeutic level of medication in the patient’s blood stream.



The physician may adjust medication dosage up or down according to peak and trough levels. Timing of specimen collection is very important. Medications administered intravenously are metabolized differently, and as such may have different optimal times for peak levels to be drawn. Always adhere to facility policy regarding the timing of therapeutic drug levels and coordinate timing with nursing staff who will be administering the medication to the patient. Do not collect the blood specimen if the medication has not completed infusing. Return for the collection after the proper amount of time has elapsed since the medication infusion was completed. Documentation should include the ending time of the last dose of medication as well as the time the blood sample was obtained. The physician should be notified immediately of any critical values.

Peak and trough levels may be ordered for the following antibiotics: amikacin, gentamicin, tobramycin, and vancomycin.

Therapeutic drug levels may be performed for patients taking the following medications: carbamazepine, digoxin, ethosuximide, lithium, methotrexate, phenytoin, procainamide, quinidine, theophylline, and valproic acid.

While technically not drugs for which therapeutic drug levels are performed, patients receiving heparin and warfarin must be monitored for their response to the medication. Both medications affect patients’ coagulation status. Patients receiving heparin will have an aPTT ordered. Those receiving warfarin will have a PT and/or INR ordered. Healthcare staff obtaining a blood specimen to be tested for aPTT from a patient receiving IV heparin must exercise great care to avoid contamination of the sample with the IV medication.

Many hospitals have established a set time for specific types of medications to be administered throughout their facility. This helps prevent confusion and miscommunication between nursing and the laboratory, making it easier for timely sample collections to be drawn. Always follow facility policy for the timing of peaks, troughs, therapeutic drug levels, tubes to be used, and all timed collections.



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### Test Your Knowledge

1. What is the purpose of testing peak and trough drug levels?
  - a) to determine if the systemic level of the drug is at therapeutic levels
  - b) to more closely monitor the cost effectiveness of treatment
  - c) to assess which drug is more effective
  - d) both a and b
2. Which of the options below most accurately reflect the definition of a trough drug level?
  - a) the highest systemic level of medication in the patient's blood, soon after the medication infusion is complete
  - b) the lowest systemic level of medication in the patient's blood, just before the next scheduled dose
  - c) an average of the lowest and highest systemic levels of medication in the patient's blood
  - d) the minimum level of medication a patient can receive and still be effective
3. Which of the options below most accurately reflect the definition of a peak drug level?
  - a) the highest systemic level of medication in the patient's blood, soon after the medication infusion is complete
  - b) the lowest systemic level of medication in the patient's blood, just before the next scheduled dose
  - c) an average of the lowest and highest systemic levels of a medication in the patient's blood
  - d) the maximum level of medication a patient can tolerate without it becoming toxic
4. What might be the impact on the patient if the level of drug in his/her system remains too high?
  - a) there is no impact as long as there is adequate medication in the system to be effective
  - b) the patient would require additional doses of the same medication
  - c) the blood level of the medication could become toxic, leading to organ damage
  - d) the patient's kidneys will filter out the excess
5. You arrive at the patient's bedside at the predetermined time to draw a peak vancomycin level. You find the vancomycin is still infusing. What should you do?
  - a) request the nurse call you when the medication has completely infused so you can return at the right time for collection of the specimen
  - b) obtain the blood specimen because it was ordered to be drawn at that time
  - c) obtain the blood specimen and note that the medication was still infusing
  - d) ask the nurse if it is okay to draw the specimen since you're already there
6. How does the physician use the information contained in therapeutic drug levels and peak and trough reports to manage patient care?
  - a) the physician will use the information to determine medication dosage and timing
  - b) the physician will use the results to determine patient tolerance of the treatment
  - c) the physician will use the information to determine the most cost-effective treatment
  - d) both a and b

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Facility/Supervisor \_\_\_\_\_ Dept: \_\_\_\_\_