Chapter 29

Intravenous to Oral Therapy Conversion

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Learning Objectives

1. Explain the rationale behind an intravenous (IV) to oral (PO) therapy conversion program.
2. Differentiate between sequential, switch, and step-down IV to PO conversion therapy.
3. Identify common medications that are included in an IV to PO therapy conversion program.
4. Identify patients who are acceptable candidates to convert from IV to PO therapy.
5. Describe the exclusion criteria that prohibit a conversion from IV to PO therapy.
6. Describe the appropriate steps involved in performing the IV to PO therapy conversion process.

Introduction

The ideal route of administration for any medication is one that achieves serum concentrations sufficient to produce the desired effect without producing undesired effects. In the past, patients were switched to oral (PO) therapy to continue treatment after an already adequate course of intravenous (IV) therapy was administered. Today, it is not uncommon to convert a patient to PO therapy as part of the initial treatment course. The available oral formulations on the market are easier to administer, safe, and achieve desired therapeutic concentrations, thus making the PO route an ideal choice.

Patients are more comfortable if they do not have an IV catheter in place. Attachment to an IV pole can restrict movement, which can hinder early and/or frequent ambulation. Patients who continue to receive parenteral therapy are at an increased risk for infusion-related adverse events. In addition, the presence of an IV catheter provides a portal for bacterial and fungal growth. These secondary infections can lead to additional antibiotic therapy, prosthesis failures, sepsis, and in a small number of cases, death. Using PO therapy also reduces hidden expenses such as the cost of IV sets and pumps, laboratory monitoring, and nursing and pharmacy personnel time. Most significantly, early use of PO therapy may allow for earlier discharge from the hospital.

Types of IV to PO Therapy Conversions

There are three types of IV to PO therapy conversions as defined below:

1. *Sequential therapy* refers to the act of replacing a parenteral version of a medication with its oral counterpart. An example is the conversion of famotidine 20 mg IV to famotidine 20 mg PO. There are many classes of medications that have oral dosage forms that are therapeutically equivalent to the parenteral form of the same medication.
2. *Switch therapy* is used to describe a conversion from an IV medication to the PO equivalent that may be within the same class and have the level of potency, but is a different compound. An example is the conversion of IV pantoprazole to rapidly dissolving lansoprazole tablets or omeprazole capsules.
3. *Step-down therapy* refers to converting from an injectable medication to an oral agent in another class or to a different medication within the same class where the frequency,

dose, and the spectrum of activity (in the case of antibiotics) may not be exactly the same. Converting from ampicillin/sulbactam 3 g IV q 6 hr to amoxicillin/clavulanate 875 mg PO q 12 hr is an example of step-down therapy.

Medications Included in an IV to PO Conversion Program

The ideal medication to include in an IV to PO therapy conversion program has several characteristics. The oral dosage form should have excellent bioavailability (ideally greater than 80%), be well tolerated upon administration, and its use should be supported by clinical data. Other optimal properties include the availability of multiple oral dosage forms (e.g., tablets and liquids) and dosing at a frequency equivalent to or less than the IV formulation.

In most hospitals, the primary drugs included in the IV to PO therapy conversion programs are antibiotics and gastrointestinal drugs. Some facilities also include cardiology and neurologic medications in their programs (see Table 29-1).

TABLE 29-1: Medications That Can Be Included in IV to PO Therapy Conversion Programs

*(Note: Medications in **bold type** are most frequently targeted for IV to PO conversion.)*

CATEGORY	SEQUENTIAL/SWITCH THERAPY	STEP-DOWN THERAPY (ORAL EQUIVALENT)[a,b]
Antibacterials	**Azithromycin**, cefuroxime, **ciprofloxacin**, clindamycin, doxycycline, **levofloxacin**, **linezolid**, **metronidazole**, **moxifloxacin**, sulfamethoxazole/trimethoprim	Ampicillin (amoxicillin), ampicillin/sulbactam (amoxicillin/clavulanate), piperacillin/tazobactam (multiple options), ticarcillin/clavulanic acid (multiple options), aztreonam (ciprofloxacin or levofloxacin), cefazolin (cephalexin), cefotaxime or ceftriaxone (cefpodoxime or cefuroxime axetil), ceftazidime or cefepime (ciprofloxacin or levofloxacin)
Antifungals	**Fluconazole**, itraconazole, voriconazole	Some institutions will initiate step-down therapy for amphotericin products and echinocandins
Antivirals	Acyclovir, ganciclovir	
Gastrointestinal	**Famotidine, cimetidine, ranitidine, esomeprazole, lansoprazole, pantoprazole**	
Cardiovascular	Digoxin, diltiazem, enalaprilat, metoprolol	
Neurologic	Phenytoin, levetiracetam, fosphenytoin (phenytoin)	

TABLE 29-1: Medications That Can Be Included in IV to PO Therapy Conversion Programs (Continued)

CATEGORY	SEQUENTIAL/SWITCH THERAPY	STEP-DOWN THERAPY (ORAL EQUIVALENT)
Endocrine	Dexamethasone, hydrocortisone, levothyroxine, methylprednisolone	
Other	Ketorolac, warfarin	

[a]For antibiotics, stepdown therapy should be confirmed based upon culture and susceptibility results.

[b]This list is not all inclusive.

General Pharmacokinetic and Pharmacodynamic Issues

The ideal oral medication should possess properties that result in minimal disruption to the treatment course. The medication should have recognized activity toward the infection or condition being treated and its use should be supported by clinical trials. To improve patient compliance, the medication should be available in dosage forms that do not limit the patient's ability to tolerate the medication. Ingesting large tablets or capsules or having to take multiple doses per day is not desirable. Finally, the medication should be well-absorbed and exhibit good bioavailability.

Bioavailability is a commonly referenced pharmacokinetic parameter. Simply put, it provides an indication of how much of an oral medication reaches the systemic circulation of a patient. Dosage formulations and bioavailability play an important role in conversion therapy. When medications are administered intravenously, the bioavailability is 100% because they are administered directly into the blood. For oral medications, bioavailability may be less due to the variability in the rate and extent of dissolution of the oral form and the total amount that is absorbed into the systemic circulation (see Table 29-2).

Selection of Patients for IV to PO Therapy Conversion

Proper identification of patients, diagnoses, medications, and contraindications to oral therapy are all essential aspects for a successful IV to PO therapy conversion program. It is very important that the pharmacist conduct a thorough and complete review of these areas so only the most appropriate patients are converted. Doing so is a benefit to both patient care and professional credibility. The criteria used to determine whether or not the patient is eligible for PO therapy vary from hospital to hospital, but they generally encompass four key areas:

1. Intact and functioning gastrointestional (GI) tract
2. Improving clinical status
3. Does not meet any exclusion criteria
4. Other

Intact and Functioning Gastrointestinal Tract

As previously mentioned, the ability of the GI tract to absorb the medication is critical for successful conversion to PO therapy. Factors that influence absorption include gastrointestinal pH,

TABLE 29-2: Oral Bioavailability of Selected Medications Available in Both IV and PO Formulations[a]

ORAL BIOAVAILABILITY		
<50%	50% TO 80%	80% TO 100%
Acyclovir	Cefixime	Amoxicillin
Azithromycin[b]	Cefpodoxime	Cephalexin
Cefuroxime axetil[c]	Cimetidine	Clindamycin
Diltiazem	Ciprofloxacin[d]	Doxycycline
Famotidine	Dexamethasone	Esomeprazole
Ganciclovir	Digoxin	Fluconazole
Ranitidine	Itraconazole	Hydrocortisone
	Levothyroxine	Ketorolac
	Metoprolol	Lansoprazole
	Pantoprazole	Levetiracetam
		Levofloxacin
		Linezolid
		Methylprednisolone
		Metronidazole
		Moxifloxacin
		Phenytoin[e]
		Sulfamethoxaxole/ trimethoprim
		Warfarin

[a]Lacy CF, Armstrong LL, Goldman MP, et al., eds. *Drug Information Handbook*. 15th ed. Hudson, OH: Lexi-Comp; 2007.

[b]Although azithromycin has a low bioavailability, it is well-distributed into tissues.

[c]Bioavailability increases to 52% when administered with food.

[d]Bioavailability ranges between 50% and 85% for the immediate-release tablet.

[e]Wide variability; depends on formulation.

surface area, and permeability. Blood flow to the GI tract is also important because this is how the absorbed medication is carried into the systemic circulation. Patients displaying signs and symptoms of shock are not candidates for conversion to oral therapy because blood flow is typically shunted away from the GI track secondary to the shock itself or due to concomitant vasopressor therapy. These types of patients normally reside in the intensive care unit.

Criteria indicating whether or not the absorption of oral medications may be compromised are listed in Table 29-3. Continuous nasogastric (NG) suctioning is a contraindication because all or part of the medication will be removed immediately after administration unless the process is temporarily suspended. Use caution with patients who have difficulty swallowing or have loss of consciousness (without feeding tube access) because they are at risk for aspiration. Issues related

TABLE 29-3: Criteria Indicating Absorption of Oral Medications May Be Compromised

- NPO status (and no medications are being administered orally)
- NG tube with continuous suction
- Severe/persistent nausea or vomiting
- Gastrointestinal transit time too short for absorption (malabsorption syndromes, partial or total removal of the stomach, short bowel syndrome)
- Active gastrointestinal bleeding
- High doses of vasopressor medications (typically in presence of shock)
- Difficulty swallowing or loss of consciousness and no NG access available
- Documented ileus or gastrointestinal obstruction
- Continuous tube feedings that cannot be interrupted and patient requires a medication known to bind to enteral nutrition formulas

to specific medications are discussed in the *specific medication class considerations* section. The nurse, physician, or in some cases, even the patient, can be good sources of information regarding the patient's ability to tolerate oral medications. An additional source of information is the patient's medication administration record (MAR). If a patient is receiving other medications by mouth, this provides confirmation that the patient can tolerate the sequential, switch, or step-down therapy.

It is important to note that the presence of tube feedings should be taken into consideration if the patient is going to be converted to PO therapy. There are certain medications, specifically the fluoroquinolones, warfarin, and phenytoin whose absorption and effectiveness are reduced in the presence of enteral feedings. This is not an absolute contraindication unless the tube feeding cannot be interrupted. The following guidelines are provided to help manage the conversion from IV to PO therapy in the presence of continuous tube feeding[1,2]:

- Select the most appropriate oral formulation of the medication for NG tube administration. Solutions or suspensions are preferred over tablets. If this is not available, a tablet can be crushed as long as it is not an extended-release or enteric-coated formulation. Dissolve the tablet in a small amount of liquid to make a slurry, and then draw the preparation into an oral syringe for administration. Once the medication has been administered, all equipment used in preparation and administration should be rinsed, and those washings administered.
- Feeding tubes should be flushed with water both before and after medication administration to avoid blockage.
- For medications considered to be compatible with tube feeding, stop the feeding and administer the medication as specified above.
- For oral fluoroquinolones, stop the tube feeding for at least 2 hours before and 2 hours after administration. For phenytoin, which is dosed more than once a day, tube feedings can be stopped approximately 1 hour before and 1 hour after medication administration.
- Medications should never be added directly into the tube feedings.

Improving Clinical Status

Signs and symptoms of the condition for which the medication is prescribed should be improving or resolving in patients being converted to PO therapy. The patient should be clinically stable and deterioration should not be expected.

Patients with active infections who are receiving antibiotics should be afebrile or have had a maximum temperature of less than 100.4°F in the previous 24 hours. White blood cell (WBC) count should be trending downward. The normalizing of WBC count indicates the patient's inflammatory response associated with the infection is declining. It is important to examine the patient's medication therapy for other medications that can cause an increase or sustained high WBC count, such as steroids. For example, some patients may be clinically improving but have maintained a WBC count above the normal reference range (referred to as *leukocytosis*) due to prednisone therapy. In this case, if the patient meets all other criteria, a safe conversion to PO therapy can still be made. Conversely, patients who are neutropenic (commonly defined as an absolute neutrophil count of less than 500 cells/mm^3) are typically excluded from IV to PO therapy conversion, but this can vary from institution to institution.

It is also important to review the cultured pathogen (bacteria, fungus, etc.) and ensure that it is susceptible to the oral medication. If no pathogen is identified, the oral agent should cover commonly suspected pathogens based upon local sensitivities and/or infection type. For example, community acquired pneumonia in a hospitalized immunocompetent patient on a general medical floor is generally caused by *Streptococcus pneumoniae*, *Haemophilus influenzae*, or atypical pathogens (such as *Chlamydophilia pneumoniae, Mycoplasma pneumoniae*, or *Legionella*). When converting from IV to PO therapy, the selected oral medication should have activity against these organisms in the absence of a positive bacterial culture.

If gastrointestinal bleeding is present, documentation that the bleeding has stopped should be verified before converting to PO therapy. For cardiovascular medications, the patient should have stable blood pressure and heart rate. For anticonvulsant medications, the patient should be stable and not be actively seizing. If in doubt, review the chart or discuss with the patient's nurse.

Exclusion Criteria

Antibiotics

Oral therapy can be commonly used to treat a variety of infections. However, there are certain infections that should be treated with parenteral therapy due to the severity or location of infection. These include endocarditis, meningitis, brain abscess, orbital cellulitis, other central nervous system infections, osteomyelitis, and endophthalmitis. Patients with multiple antibiotic allergies may be restricted to therapy choices that may only be available parenterally.

Antiepileptic Medications

Patients who are at risk for actively seizing or are unable to tolerate oral medications without risk of aspiration are not appropriate candidates for PO therapy.

Cardiovascular

Patients with unstable cardiac conditions or for whom frequent dose changes are occurring (e.g., through IV drip titration) are not good candidates for PO therapy.

Other

Some hospitals may require that patients have received at least one dose of intravenous medication or have been hospitalized for at least 24 hours.

Specific Medication Class Considerations

Fluoroquinolones

Ciprofloxacin, moxifloxacin, and levofloxacin are included in almost all hospital IV to PO therapy conversion programs. These medications are ideal for conversion because of high bioavailability, rapid absorption, and good distribution within the body. Remember that fluoroquinolone absorption may be affected by concurrent administration of products containing divalent and trivalent cations such as calcium, calcium containing antacids, iron and zinc salts as well as medications like didanosine and sucralfate. For example, ciprofloxacin should be given 2 hours before or 6 hours after these products according to the manufacturer's package insert. Levofloxacin can be administered 2 hours before or 2 hours after these medications and moxifloxacin should be administered 4 hours before or 8 hours after these products. Ciprofloxacin suspension should not be administered via a feeding tube due to its physical characteristics. From a dietary perspective, all quinolones can be taken without regards to meals.[3]

Triazole Antifungals

The oral bioavailability of fluconazole, itraconazole, voriconazole, and posaconazole is relatively good if administered appropriately. Fluconazole is well-absorbed in most patient types and is not affected by food or alteration in gastric pH. One study conducted in surgical patients with compromised gastrointestinal absorption receiving enteral nutrition reported fluconazole bioavailability to be 100%.[4] Itraconazole is unique among the triazoles in that it requires an acidic gastric pH for absorption. Antacids, H2 receptor antagonists, and proton-pump inhibitors can significantly reduce itraconazole's bioavailability. In the product package insert, the manufacturer recommends administering the medication with a cola beverage if the patient is concomitantly receiving an H2 antagonist. Sucralfate may also affect itraconazole's absorption. The solution is better absorbed on an empty stomach while the capsules should be administered with food. On the other hand, voriconazole is best absorbed if administered 1 hour prior to or 1 hour after meals. Both itraconazole and voriconazole intravenous formulations are contraindicated in renal dysfunction because of the potential to accumulate cyclodextran (from the solution), which can lead to toxicity. Finally, posaconazole oral suspension should be administered with high fat foods or tube feedings, if possible, as this significantly increases absorption.

Vancomycin

This antibiotic is unique because it is one of the few medications where the oral and IV formulations have different uses. The IV formulation is used to treat gram positive bacterial infections. However, the oral formulation is poorly absorbed and is typically only used in the treatment of *Clostridium difficile* colitis. This medication should not be included in an IV to PO therapy conversion program.

Other Antibiotics

Some antibiotics are better absorbed on an empty stomach, while others are better absorbed with food or a high fat meal. Dietary restrictions vary for other types of antibiotics. Linezolid is unique because it is a weak, nonselective reversible inhibitor of monoamine oxidase (MAO). Patients receiving this drug should not consume foods or beverages that are high in tyramine because it can place them at risk for a serotonin-syndrome type reaction, which leads to a severe hypertensive reaction.[5] Although these foods are not commonly administered in the hospital setting, it is still a concern and many institutions will place patients on a low tyramine diet as a preventative measure.

Acid Suppression Medications (H2 receptor antagonists and proton pump inhibitors)

Because of their mechanism of action, the proton pump inhibitors (PPIs) are most effective when administered on an empty stomach or at least 30 minutes to 1 hour prior to meals. Some of the PPIs are enteric-coated granules that can be sprinkled on fruit or mixed in solution prior to administration through a feeding tube. It is important to not crush or chew these granules and to dissolve them only in acidic substances to keep the enteric coating intact. It is not uncommon for patients to receive these drugs intravenously due to GI bleeding. As previously stated, these patients should not be converted to PO therapy until the active GI bleeding has been resolved.

Pharmacoeconomics of IV to PO Therapy Conversion

Changing the route of administration from intravenous to oral results in direct cost reductions (medication costs, supply costs) that are easy to document and calculate. Personnel time spent preparing and administering doses is greatly reduced. There are several studies that document the direct impact of an aggressive and early IV to PO therapy conversion program. One study that specifically focused on levofloxacin found proactive conversion to the oral formulation reduced the length of stay by 3.5 days and saved approximately $60 of medication/supply costs and almost $3,300 in total hospital costs for each patient.[6] Another recent study documented that early conversion from IV to PO therapy in community acquired pneumonia decreased length of stay by almost 2 days, while having no negative effects on mortality or clinical cure.[7]

Myths of IV to PO Therapy Conversion

If IV to PO therapy conversion can positively impact patient and economic outcomes, why is it not more widely used? Why do not all hospitals have automatic conversion programs? The three misconceptions listed below must be overcome to have a successful conversion program.

Myths

1. Infectious diseases need intravenous treatment and conversion to oral therapy should be used sparingly. Oral antimicrobials are not equivalent to intravenous therapy.

   Answer: Newer antimicrobials are available with equivalent intravenous and oral bioavailability. The literature has shown that IV to PO therapy conversion is efficacious, convenient, cost-effective, and safe in carefully selected patients.

2. The oral antimicrobial must be the same medication or from the same medication class as the intravenous agent.

   Answer: The selected oral agent should cover the same or similar spectrum of activity, similar tissue penetration, and should be effective against the isolated or suspected organism(s).

3. Medicare will not reimburse for the care of inpatients on oral therapy.

   Answer: Many use the presence of an intravenous antimicrobial as their primary justification for hospitalization. Typically, if the patient has other medical issues, then converting to PO therapy should not compromise the ability to remain hospitalized. However, if the patient is receiving IV medications and there are no other medical issues to address, conversion to PO therapy will expedite discharge. If PO therapy is not available, home healthcare or transfer to a skilled nursing facility may be necessary. Case management at the local facility can provide specific guidance on this issue. Typically education must be performed to alter this thought process.

Summary

Intravenous to oral therapy conversion represents a cost-effective strategy that also minimizes intravenous therapy complications and facilitates earlier hospital discharge. Appropriate oral medication use produces equivalent clinical outcomes, causes fewer complications, less patient inconvenience, and is generally less costly. There are many medications that can be included in this program.

Patients eligible for IV to PO therapy conversion should

- tolerate oral medications,
- be converted to an oral agent that acts similarly or equivalent to the IV counterpart,
- meet inclusion criteria,
- not have any contraindications to PO therapy, and
- be improving clinically.

Through an IV to PO therapy conversion program, pharmacists have the opportunity to reduce unnecessary medication costs while maintaining the efficacy of therapy and improving patient safety and comfort.

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Intravenous to Oral Therapy Conversion

Name: _____ **Date:** _____

KNOWLEDGE AND SKILLS	YES	NO
Describes the potential benefits of conversion from IV to PO therapy.		
Differentiates between sequential, switch, and step-down therapy.		
Describes the ideal characteristics of a medication that is included in an IV to PO therapy conversion program.		
Identifies medications that are commonly included in an IV to PO therapy conversion program.		
Demonstrates knowledge of conditions that would exclude patients from being converted from IV to PO therapy.		
Identifies situations in which the absorption of oral medication would be compromised.		
Describes appropriate techniques for administering a fluoroquinolone in a patient receiving medications containing divalent and trivalent cations.		
Describes appropriate methods of administering oral medications to a patient receiving tube feedings.		
Identifies patients who are appropriate candidates for IV to PO therapy conversion.		
Makes recommendations for the appropriate selection, dosage, administration, and monitoring of medications in IV to PO therapy conversions.		
Monitors patients undergoing IV to PO therapy conversion for avoidance of drug-drug, drug-food, and drug-disease interactions, and evidence of adverse drug reactions, overdosage, and other medication-related problems.		
Makes appropriate recommendations to manage adverse effects and other medication-related problems and ensure positive therapeutic outcomes in patients undergoing IV to PO therapy conversion.		

Competence certified by: _____ **Date:** _____

Intravenous to Oral Therapy Conversion

Name: _____ **Date:** _____

Use the following case report to select the best answers to questions 1 through 5.

K.W. is a 78-year-old female admitted for urosepsis. Vital signs on admission: blood pressure 90/67 mm Hg; HR 90 beats/min; temperature 101.5°F, and a white blood cell (WBC) count of 9,000 cells/mm^3. She was started on ciprofloxacin 400 mg IV q 12 hr, famotidine 20 mg IV q 12 hr, and IV fluids. She was taking an oral blood pressure medication prior to admission, but this was held secondary to the hypotension. The nurse also noted in the chart that the patient was nauseous and has not been able to tolerate anything orally.

___ 1. Which of the following conversion examples demonstrates the concept of IV to PO sequential therapy?
   a. Ciprofloxacin 400 mg IV q 12 hr to ciprofloxacin 500 mg PO q 12 hr
   b. Famotidine 20 mg IV q 12 hr to ranitidine 50 mg IV q 8 hr
   c. Aztreonam 1 g IV q 8 hr to ciprofloxacin 500 mg PO q 12 hr
   d. Famotidine 20 mg PO q 12 hr to famotidine 20 mg IV q 12 hr

___ 2. The IV dose of famotidine is higher than the PO dose of famotidine on a milligram per milligram basis and a dose reduction should be made when converting to PO therapy.
   a. True
   b. False

___ 3. Which of the following excludes this patient from receiving oral therapy on admission?
   a. Patient's blood pressure medication is held
   b. Patient is hypertensive
   c. Patient is nauseous and is not tolerating anything orally
   d. All of the above

New information: After 3 days of treatment, the patient appears to be improving clinically. Her oral blood pressure medication has been restarted, the rate of IV fluids decreased, her nausea has subsided, and she is eating about 50% of her meals. Her WBC count is 6,500 cells/mm^3 and her temperature is 98.7°F (Tmax = 99.0°F).

___ 4. Which of the following must be present for an appropriate IV to PO therapy interchange?
   a. An oral medication with poor bioavailability
   b. Able to tolerate oral intake
   c. Presence of severe infection such as endocarditis or osteomyelitis
   d. Clinical instability

___ 5. What factors make this patient eligible to tolerate IV to PO therapy conversion?
   a. Patient is taking critical oral medications by mouth
   b. Patient is eating 50% of her meals
   c. WBC count trending downward and afebrile
   d. All of the above

Use the following case report to select the best answers to questions 6 and 7.

S.L. is a 62-year-old male who presented to the hospital with complaints that he was coughing up blood. This patient has a lengthy history of alcohol abuse and has been admitted several times before. He is placed on NPO status and undergoes an endoscopic evaluation which reveals active GI bleeding. The gastroenterologist orders lansoprazole IV. Overall, S.L. looks to be in relatively stable condition with the exception of a low blood pressure and a temperature of 100.2°F. Pertinent past medical history indicates he was diagnosed in a physician's office 8 days prior to admission with bronchitis for which he was given a full course of azithromycin and methylprednisolone tablets.

___ 6. Why is SL not a candidate for PO therapy at this time?

a. Temperature is elevated to 100.2°F

b. Active GI bleeding

c. Recent diagnosis of bronchitis

d. Medicaid will not pay for the hospital stay

___ 7. The only reason to perform IV to PO therapy conversion is to reduce pharmacy expenditures.

a. True

b. False

Use the following case report to select the best answers to questions 8 through 10.

D.R. is an 18-year-old male who is brought to the ED and is actively seizing. He has no significant past medical history however his mother reports that he recently developed severe headaches and a high fever that started within the last 24 hours. Initial medications ordered include fosphenytoin, ceftriaxone, vancomycin, and dexamethasone (all given by the IV route). A lumbar puncture is performed. Results return and the patient is diagnosed with bacterial meningitis. He is admitted to the ICU where he is intubated and started on mechanical ventilation. Several days later, an NG tube is placed and he is started on tube feedings. His current temperature is 101.7°F.

___ 8. Which of the following medications should not be converted to oral therapy due to a difference in therapeutic activity when given orally?

a. Vancomycin

b. Dexamethasone

c. Ceftriaxone

d. Fosphenytoin

___ 9. Which of the following medications in its equivalent oral form is most likely to interact with the tube feedings if administered concomitantly?

a. Vancomycin

b. Dexamethasone

c. Ceftriaxone

d. Fosphenytoin

___ 10. Which of the following statements is true based on D.R.'s clinical presentation?

a. The patient cannot receive oral medications because he is on a ventilator.

b. The antibiotics should continue to be administered intravenously due to the diagnosis of meningitis.

c. If converted to oral phenytoin, the tube feedings would have to be held for 6 hours before and 6 hours after administration of the medication.

d. The patient can be converted from IV vancomycin to PO linezolid.

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Answer Key

1. a
2. b
3. c
4. b
5. d
6. b
7. b
8. a
9. d
10. b