

REHAB SUMMIT

107: Hip & Knee Total Joint Replacement Surgery - New Options for Pain Management

Terry Rzepkowski, DPT, MS, BS

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Terry Rzepkowski, DPT, MS, BS

Financial: Terry Rzepkowski is an Assistant Professor for Nova Southeastern University Tampa; and an Assistant Professor for South University Tampa. He receives a speaking honorarium from PESI, Inc.
 Non-financial: Terry Rzepkowski is a member of the American Physical Therapy Association (APTA).

Pain Management following LE total joint replacement surgery



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About the instructor

Dr. Terry L Rzepkowski, DPT, MS, BS



Dr. Terry L Rzepkowski, DPT, MS, BS, is a Doctor of Physical Therapy with specialization in Orthopedic Physical Therapy. Throughout his 38-year career, he has specialized in Orthopedics, specifically: Musculoskeletal out-patient rehab as an independent private practitioner, Total Joint Replacement Surgery, Sports Medicine, and Orthopedic Homecare. This extensive background allows him to relate his knowledge of the complex rehab patient from prevention strategies including rehabilitative exercises, lifestyle and activity modifications through all phases of post-op rehabilitation.

About the instructor, Continued

A professor in the Health Science department for Nova Southeastern University Terry provides instruction in Anatomy, Biomechanics, and Kinesiology; Terry has extensive knowledge in relating the complexities of the shoulder patient. Terry's current clinical role as home care therapist working exclusively with orthopedic surgical patients in Tampa FL, provides a platform for staying abreast of the latest techniques, protocols, and medication guidelines utilized in joint care rehab. As a sought-after presenter, he enjoys sharing his knowledge with interdisciplinary audiences around the country. Terry has spoken professionally on pharmacology for clinicians, shoulder, knee, and hip injuries with advances in arthroscopic repair.

Focus on Medication Management

- Pharmaceutical therapy is the most common medical intervention used to treat the elderly
- Medication Management aims to help providers improve medication management, reduce adverse medication events, and help patients receive optimal effects from their pharmaceutical therapy.

Focus on Medication Management Disclaimer

- This presentation is given by a physical therapist with knowledge and study in medications as a guide to clinical practice. Any information is not to be taken as medical advice.
- This presentation is to make healthcare providers who are not a Doctor or Pharm. D. aware of possible medications issues for their patients and some guidelines to help manage them. It is not a substitute for conferring with the prescribing physician.

Pain Management Objectives

Understanding:

- LE Nerve blocks to reduce narcotics for pain.
- Conventional pain management and its cons
- Tran examic acid for LE total joints
- Non-narcotic pain cocktails for LE total joints
- Online tools for pill identification and possible interactions
- Factors contributing to prescription opioid addiction
- Caregivers and the importance of Narcan

Pain and inflammation

- **NSAIDs:** OTC: Aspirin, Ibuprofen (Advil, Motrin), Naproxen sodium (Alleve).
- **Prescription:** Celcoxib (Celebrex), Meloxicam (Mobic)
- **Pain meds**
- **Oxycodone:** is fast acting **Oxycontin** is time released
- **Hydrocodone:** Lortab®, Lorcet®, Vicodin®, Zydone®
- **Fentanyl:** Duragesic patch
- **Opioid combinations with APAP** (acetaminophen): Darvocet (banned due to cardiac side effects) Percodan, Percocet (generic name oxycodone), Tylenol with Codeine, Tylox .
- **Note:** Opioids remain the mainstay of postoperative pain treatment in spite of strong evidence of their drawbacks.

Orthopedic management

- Peri-operative blocks
- Pain cocktail
- Peri-operative Hemostasis
- Blood thinners
- Nicotine







Operative analgesia

Types	Examples
• Nerve blocks (surgical)	Lidocaine, Ropivacaine, Bupivacaine
• Intra articular injections	Exparel, liposomal bupivacaine

• Regional anesthetic techniques are the most effective methods to treat postoperative pain.

Local anesthetics are broken down into two categories: ester-linked and amide-linked.

- Ester-linked: benzocaine, procaine
- Amide-linked: lidocaine, bupivacaine, ropivacaine
- Short acting, procaine 90-180 minutes
- Intermediate acting, lidocaine 90-180 minutes
- Long acting, bupivacaine 4-18 hours

Perioperative Analgesia



Perineural techniques are good alternatives for major orthopedic surgery but remain underused.

- The **Femoral** cutaneous branches assist with anterior approach hip pain.
- **Obturator** blocks are used for the knee to reduce any quad muscle weakness.

Peri-operative Hemostasis

- **Tranexamic acid (TXA)** is a synthetic derivative that exerts its antifibrinolytic effect. There are three main routes: intravenous (IV), intra-articular (**topical**), and combined (IV and topical)
- The reported prevalence of **red blood cell transfusions** in unselected patients undergoing hip or knee replacement varies between 21% and 70%. When tranexamic acid was used as a routine prophylaxis overall transfusion rate was 16% (18% in hip patients and 11% in knee patients, $p = 0.19$).⁶
- Oral vs intravenous tranexamic acid in total-knee arthroplasty and total hip arthroplasty was presented by Chen in 2019 reporting that Oral TXA is equivalent to IV TXA in reducing perioperative blood loss and should be recommended in TKA and THA.

Polling Question

1. What is a method of operative pain management for a TKA?
 - A. Topical Tranexamic acid
 - B. Femoral nerve block
 - C. Intravenous Tranexamic acid
 - D. Obturator nerve block



DVT

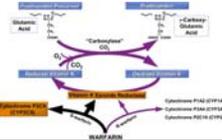
- DVT = Deep Vein Thrombosis
- PDVT = Proximal Deep Vein Thrombosis
- PE = Pulmonary Embolus
- T.E.D. = Thrombo Embolytic Deterrent
- According to AAOS guidelines DVT occurs in about 37 percent of patients undergoing Total Joint Arthroplasty without prophylaxis, as detected by imaging.
- Strategies: Anti-embolus stockings, active muscles pump exercises, IPC (intermittent pneumatic compression), moderate ambulation, and anti-coagulant therapy.

Blood thinners

Types	Examples
• Vitamin K antagonists	• Warfarin (Coumadin)
• Low molecular weight heparins (LMWH) and heparin	• Enoxaparin (Lovenox), Heparin
• Thrombin inhibitors	• Dabigatran (Pradaxa)
• Factor Xa Inhibitors	• Apixaban (Eliquis), Rivaroxaban (Xarelto)

Anticoagulants

•Definition- **Anticoagulants** are drugs that are used to prevent blood from forming clots.⁵ There are two main types of anticoagulants, vitamin K antagonists and heparins. Both these drugs prevent blood from clotting but go about it in slightly different ways.


Vitamin K antagonists

- Vitamin K antagonists work by competing with the liver for vitamin K. Vitamin K is needed by the liver in order to make certain proteins that help the blood to clot.⁶
- Known as warfarin or Coumadin
- Taken orally
- Can take a several days before effects occur⁶

❖ **Patients on anticoagulants** can experience excessive bleeding, signs to watch for are usual bleeding from gums when brushing teeth, dark or brown urine, blood in the urine, blood in feces, dark and tarry stools, excessive new bruising, and increased bloody wound drainage.

Heparin

- Most common fast acting^{7,8}
- Anticoagulation effects seen immediately
- Taken parenternally (generally IV)
- Works by increasing the activity of antithrombin III which binds to several clotting factors. This reduces clotting and thrombogenesis.⁹

The diagram illustrates the mechanism of Heparin. Heparin (represented by a green plus sign) increases the activity of Antithrombin III (represented by a green plus sign). Antithrombin III then inhibits Thrombin (Factor II), which is shown with a red circle and slash. Thrombin normally converts Fibrinogen (Factor I) into Fibrin, as indicated by a black arrow.

New drugs oral

- Dabigatran (Pradaxa)
 - Taken orally
 - Directly inhibits free thrombin, fibrin-bound thrombin, and thrombin-induced platelet aggregation⁹
 - Binds to the active site of free and clot bound thrombin, blocking its coagulant capability⁶
 - Dosage- 150 mg twice daily
 - Approved for:^{9,10}
 - Prevention of stroke in patients with atrial fibrillation
 - Treatment and prevention of recurrent venous thromboembolism
 - Advantages over warfarin- decreases risk of stroke and life-threatening bleeding complications
 - Disadvantages- increased risk GI bleeding

New drugs oral

Apixaban (Eliquis) and Rivaroxaban (Xarelto)

- Direct, highly selective, orally active inhibitors of activated factor X^{9,10}
- Dosage-
- Apixaban- 5 mg twice daily
- Many factors influence dosage including age and weight⁶
- Rivaroxaban-
- TKA- 10 mg/d for 12-14 days
- THA- 10 mg/d for 35 days
- DVT/PE- 15 mg twice daily for 3 weeks, then 20 mg once daily for 3+ months
- Approved for:^{9,10}
 - Prevention of venous thromboembolic events
 - Prevention of stroke and systemic embolism
- Rivaroxaban for treating and preventing DVT and pulmonary embolism

New drugs injectable



- **Fondaparinux sodium (Arixtra)**
- (ATIII)-mediated selective inhibition of Factor Xa
- 2.5 mg administered by subcutaneous injection once daily. The usual duration of therapy is 5 to 9 days.
- Indications: In patients undergoing hip fracture surgery, including extended prophylaxis;
- in patients undergoing hip replacement surgery;
- in patients undergoing knee replacement surgery
- **Enoxaparin sodium (Lovenox)**
- 30 mg every 12 hours administered by SC injection. The usual duration of administration is 7 to 10 days
- Indications: In patients undergoing hip replacement surgery, during and following hospitalization.
- in patients undergoing knee replacement surgery.

Polling Question



2. The best choice for immediate treatment for a PE is?

- A. Coumadin
- B. Xarelto
- C. Heparin
- D. Lovenox 

Affects of smoking on circulation



- Smoking is a disaster waiting to happen in the post-op patient. The effects of 1 cigarette can result in a 42% reduction in distal and capillary blood flow.
- Smoking increases the amount of nicotine in the blood stream which quickly initiates vasoconstriction of capillary and distal blood flow as part of a sympathetic ANS reaction.
- These effects lead to delayed healing and potential wound site complications.



Smoking and Surgical risk AOS studies

- TKA surgery had a 10-fold higher revision rate compared to non-smokers, smoking group had 13 knee replacement failures (10 percent) compared to five in the non-smoking group (1 percent). Complications of deep venous thrombosis (DVT) or blood clots, anemia requiring treatment, cardiac problems, and acute renal failure. 21% smoking and 12% non-smoking.
- THA surgery looked at the effects of smoking on patients who underwent reconstruction of the acetabulum with ultra porous metal. The failure rate in smokers was 9.1 percent, compared to 3.4 percent in non-smokers.
- Investigators recommend that orthopedic surgeons strongly advocate for smoking cessation before surgery to ensure optimal recovery and outcome.

CDC on Nicotine Dependence

- Most smokers become addicted to nicotine, a drug that is found naturally in tobacco.
- More people in the United States are addicted to **nicotine than to any other drug**. Research suggests that nicotine may be as addictive as heroin, cocaine, or alcohol.
- Quitting smoking is hard and may require several attempts. People who stop smoking often start again because of withdrawal symptoms, stress, and weight gain.
- Smokefree.gov devotes multiple resources from their web page <https://smokefree.gov/> and gives this advice. Getting support from the important people in your life can make a big difference when you quit smoking. Friends, family, co-workers, and others can be there for you. You are not alone.

Perioperative Analgesia

What is Exparel?
EXPAREL
 (dupixacaine liposome injectable suspension)
OPIOID FREE

control while reducing opioid use**

78% FEWER OPIOIDS (mean opioid consumption)

13.6% LESS PAIN (cumulative pain rating)

**Based on an 800mg single injection of EXPAREL (n=100) compared to a control group of 100mg morphine (n=100) in a randomized, double-blind, controlled trial. The primary endpoint was the total number of opioid tablets consumed over 24 hours. The secondary endpoint was the cumulative pain rating over 24 hours. P-values are shown in bold. Error bars represent standard deviation. *P < 0.05, **P < 0.001.

Drug Categories



- The DEA has 5 drug classification schedules to identify the level for potential abuse and addiction.
- United States Pharmacopeia (USP) currently categorizes a drug or drug component under one of 49 different therapeutic classes. We will not attempt to discuss them all, rather the ones more common to our patients



Rehab Patient Drugs



Systemic	Arthritis Medications
Allergy and cold	Anti inflammatory
Anti anxiety/depression	Corticosteroids
Anti hypertensive	Pain relievers
Cardiac	Operative analgesia
Blood thinners	Perioperative blood loss
Diabetes(Type II)	Regenerative Injections
Muscle relaxors	Rheumatoid Medications

Anxiety/Antidepressant Medications



Types	Examples
• Benzodiazepines	• Alprazolam (Xanax)
• Selective serotonin reuptake inhibitors (SSRIs)	• Escitalopram (Lexapro)
• Tricyclics	• Clomipramine (Anafranil)
• Monoamine oxidase inhibitors (MAOIs)	• Phenelzine (Nardil)
• Beta-blockers (C)	• Propranolol (Inderal)

Anti anxiety/depression

Type	Example	Action	Interaction
Benzodiazepines	Xanax	Cause mild to severe depression of the nerves within the brain (central nervous system) and sedation (drowsiness)	<u>Addiction potential</u> , drugs that cause drowsiness: Alcohol, sleeping, narcotics, sedatives, muscle relaxant medications
SSRIs	Lexapro	Work by inhibiting the reuptake of specific neurotransmitters, hence increasing their levels	Not to be combined with drugs that increase brain serotonin levels, MAOIs, St. John's wort, NSAIDs
MAOIs	Nardil	MAOIs elevate the levels of norepinephrine, serotonin, and dopamine by inhibiting an enzyme called monoamine oxidase.	Other anti depressants, St. John's wort, epinephrine, dopamine

High blood pressure (hypertension) medications/Cardiac

Types	Examples
• ACE inhibitors	• Captopril (Capoten)
• ARB (angiotensin II receptor blockers)	• Candesartan (Atacand)
• Beta blockers	• Metoprolol (Lopressor, Toprol XL)
• Calcium channel blockers (CCBs)	• Amlodipine (Norvasc)
• Diuretics	
• Alpha-blockers	• Hydrochlorothiazide (Hydrodiuril)
• Alpha-beta blockers	• Doxazosin (Cardura)
	• Carvedilol (Coreg)

Additional Cardiac Meds

Types	Examples
• Anticoagulants	• Rivaroxaban (Xarelto), Warfarin
• Antiplatelet Agents and Dual Antiplatelet Therapy (DAPT)	• Aspirin + Clopidogrel (Plavix [®])
• Angiotensin-Receptor Neprilysin Inhibitors (ARNIs)	• Sacubitril/valsartan (Entresto) (Dual action)
• Cholesterol-lowering medications	
• Digitalis Preparations	• Statins: Atorvastatin (Lipitor)
• Vasodilators	• Digoxin and Digitoxin
	• Nitroglycerin tablets



High blood pressure (hypertension) medications/Cardiac (C)

Type	Example	Action	Interaction
ACE inhibitors	Captopril	(Inhibit) the activity of the enzyme ACE , which decreases the production of angiotensin II. As a result, blood vessels enlarge or dilate, and blood pressure is reduced.	NSAIDs may reduce the blood pressure-lowering effects of ACE inhibitors.
Angiotensin receptor blockers (ARBs)	Candesartan	Prevent angiotensin II from binding to angiotensin II receptors on the muscles surrounding blood vessels. As a result, blood vessels enlarge (dilate), and blood pressure is reduced	Avoid combining with ACE inhibitors (hypotension) and may increase potassium levels



High blood pressure (hypertension) medications/Cardiac (C)

Type	Example	Action	Interaction
Beta blockers	Lopressor	Binding to both beta 1 and beta 2 receptors blocking the effect of norepinephrine and epinephrine, beta blockers reduce blood pressure by dilating blood vessels and reducing heart rate	Antihypertensive and antianginal drugs, anti-arrhythmic, NSAIDs, psychotropic drugs, anti-ulcer medications, anaesthetics, warfarin, oral hypoglycaemics
Calcium channel blockers (CCBs)	Norvasc	Reduces the force of the heart's muscular pumping action (cardiac contraction) and thereby reduces blood pressure. These medications also relax the muscle cells surrounding the arteries to further reduce blood pressure.	Avoid taking with grapefruit juice , or alcohol (hypotension) and products that could raise BP cough -and-cold products, diet aids, or NSAIDs



High blood pressure (hypertension) medications/Cardiac (C)

Type	Example	Action	Interaction
Diuretics (water pill)	Hydrochlorothiazide Lasix (loop diuretic)	Promote the removal of salt from the body. Water (fluid) also is removed along with the salt; however, the exact mechanism whereby diuretics lower blood pressure is not clearly known.	Dehydration potential. Avoid taking with alcohol, caffeine, NSAIDs (renal failure) cortico steroids (Potassium loss)
Alpha-blockers	Cardura	Reduces the force of the heart's muscular pumping action (cardiac contraction) and thereby reduces blood pressure. These medications also relax the muscle cells surrounding the arteries to further reduce blood pressure.	Avoid taking with ED medications, Flomax

High blood pressure (hypertension) medications/Cardiac (C)

Type	Example	Action	Interaction
Alpha-Beta blockers	Coreg	Work the same way as alpha-blockers but also slow the heartbeat as beta-blockers do. As a result, less blood is pumped through the vessels, vessels dilate and blood pressure is lowered.	Avoid products that could raise BP <u>cough</u> -and-cold products, diet aids, or NSAIDs
Antiplatelet Agents and Dual Antiplatelet Therapy (DAPT)	Aspirin and a second (Dual) Antiplatelet. inhibits the binding of adenosine diphosphate (ADP) to its platelet P2Y12 receptor blocking platelets from sticking together and prevents them from forming harmful clots.		Avoid NSAIDs and fish oils that increase blood thinning, Conversely avoid heartburn meds omeprazole or esomeprazole because both significantly reduce the antiplatelet activity of Plavix

High blood pressure (hypertension) medications/Cardiac (C)

Type	Example	Action	Interaction
Angiotensin-Receptor Nephrylsin Inhibitors (ARNIs)	Entresto	Dual action of a nephrylsin inhibitor and angiotensin receptor blocker. 	Avoid other ARBs, pain meds, diuretics, or NSAIDs
Cholesterol-lowering medications	Lipitor	Works by reducing the liver's production of cholesterol. They block an enzyme called HMG CoA Reductase that the liver uses to make cholesterol.	Avoid grapefruit juice, antacids, coumadin, anti fungal, biotic and hypertensive medicines

High blood pressure (hypertension) medications/Cardiac (C)

Type	Example	Action	Interaction
Digitalis Preparations	Digoxin and Digitoxin	It slows down the rate at which the heart beats, and also increases the force with which the heart muscle contracts with every heartbeat. This makes each heartbeat more efficient at pumping blood around the body	Diuretics, corticosteroids, St. John's Wort. Separate by at least 2 hrs. Metamucil, and antacids
Vasodilators	Nitroglycerin	Action of nitroglycerines relaxation of vascular smooth muscle. Although venous effects predominate, nitroglycerin produces, in a dose-related manner, dilation of both arterial and venous beds.	Avoid all ED medications and certain migraine medications

Type II (adult onset) Diabetes medications

Types

- Alpha-glucosidase inhibitors
- Biguanides
- Dopamine agonist
- **DPP-4** inhibitors
- Glucagon-like peptides (incretin mimetics)
- Meglitinides
- Sodium glucose transporter (**SGLT**) 2 inhibitors
- **Sulfonylureas**
- **Thiazolidinediones**

Examples

- Acarbose (Precose)
- **Metformin**-canagliflozin (Invokamet)
- Bromocriptine (Cycloset)
- Sitagliptin (Januvia)
- Dulaglutide (Trulicity)
- Repaglinide (Prandin)
- Dapagliflozin (Farxiga)
- Glimepiride (Amaryl)
- Rosiglitazone (Avandia)

Diabetes(Type II)

Type	Example	Action	Interaction
Biguanides	Invokamet Metformin	Decrease how much sugar your liver makes. They decrease how much sugar your intestines absorb, make your body more sensitive to insulin, and help your muscles absorb glucose.	Possible lactic acidosis, avoid digoxin, quinidine, trime thoprim, and vancomycin
Glucagon-like peptides	Trulicity	They increase B-cell growth and how much insulin your body uses. They decrease your appetite and how much glucagon your body uses. They also slow stomach emptying.	Alcohol, tobacco, A total of 645 drugs are known to interact with Trulicity
DPP-4 inhibitors	Sitagliptin (Januvia)	DPP-4 inhibitors slow the inactivation and degradation of GLP-1, a hormone involved in glucose removal from the gut.	Those undergoing treatment for liver/kidney disease need close monitored

Diabetes(Type II)

Type	Example	Action	Interaction
Sodium glucose transporter (SGLT) 2 inhibitors	Farxiga Invokana	These drugs work by preventing the kidneys from holding on to glucose. Instead, your body gets rid of the glucose through your urine.	Beta-blocker medications, A total of 763 drugs are known to interact with Farxiga
Sulfonylureas	Amaryl	They work by stimulating the pancreas with the help of beta cells. This causes your body to make more insulin.	(ACE) inhibitors, NSAIDS, MAOIs, Steroids
Thiazolidinediones	Avandia	Thiazolidinediones work by decreasing glucose in your liver. They also help your fat cells use insulin better.	Increased risk of heart disease. Interact with diuretics, statins, aspirin, plavix

Polling Question

3. The most common drug taken by older community dwelling patients?

- A. Hypertensive medications
- B. Blood thinners
- C. Hypoglycemics
- D. Cortisone



Time for a break!



Muscle relaxers

Types	Examples
• Antispasmodics: skeletal muscle relaxants (SMRs)	• Carisoprodol, (Soma)
• Antispastics	• Methocarbamol, (Robaxin)
Off Label	• Baclofen (Lioresal)
• Benzodiazepines	• Alprazolam (Xanax)
• Clonidine	• Clonidine (Kapvay)
• Gabapentin	• Gabapentin (Neurontin)

Muscle Relaxers

Type	Example	Action	Interaction
skeletal muscle relaxants	Soma Robaxin	They're thought to work by causing a sedative effect or by preventing your nerves from sending pain signals to your brain.	Can be habit forming avoid, alcohol, opioid pain medication, antihistamines, cough medicine, or sleep aids
Antispastics	Baclofen	Block nerve signals from the spinal cord that cause muscles to spasm.	Avoid, alcohol, opioid pain medication, antihistamines, cough medicine, or sleep aids
Anxiolytic and sedative	Valium	Used to treat anxiety, relieve muscle spasm. It works by calming the brain and nerves.	Opioid pain relievers, antihistamines, muscle relaxants and alcohol

Drug Classifications, Schedule I, II, III, IV, V

Schedule	Description	example
1	Currently accepted medical use in the United States, a lack of accepted safety for use under medical supervision, and a high potential for abuse.	heroin, lysergic acid diethylamide (LSD)
2	High potential for abuse which may lead to severe psychological or physical dependence.	oxycodone (OxyContin, Percocet),
3	May lead to moderate or low physical dependence or high psychological dependence.	Vicodin
4	have a low potential for abuse relative to substances in Schedule III.	Xanax, Soma,
5	have a low potential for abuse relative to substances listed in Schedule IV	cough preparations Robitussin AC, Phenergan with Codeine

Medication reactions

- Drug allergy symptoms with urgent MD consultation may include: Skin rash, hives, itching, fever, swelling, shortness of breath, wheezing, runny nose, itchy, watery eyes, restlessness.
- Conditions requiring immediate medical action are nausea or abdominal cramps, confusion, vomiting or diarrhea, dizziness or lightheadedness, if nursing unavailable then Emergency medical attention, if no transportation available 911.
- Emergency medical attention 911: Tightening of the airways and throat causing trouble breathing, weak/rapid pulse, significant drop in blood pressure, seizure, loss of consciousness.

Plasma Drug Levels

- Peak plasma level:** The time for drug to reach peak concentration in plasma (Bio-availability) is called as the time of peak concentration. It is expressed in hours and is useful in estimating the rate of absorption. Onset time and onset of action are dependent upon t_{max} .

The graph shows plasma concentration on the y-axis and time post-ingestion on the x-axis. The curve rises during the absorption phase, reaching a peak at C_{max} at time T_{max} . It then declines during the elimination phase. A vertical dashed line marks the 50% decrease in concentration, which is used to determine the elimination half-life. The initial delay before the concentration begins to rise is labeled as absorption lag time.

Plasma Drug Levels

- Half life:** The elimination half-life of a drug is a pharmacokinetic parameter that is defined as the time it takes for the concentration of the drug in the plasma or the total amount in the body to be reduced by 50%. In other words, after one half-life, the concentration of the drug in the body will be half of the starting dose.

The left graph shows a typical concentration-time curve with the area under the curve (AUC) shaded. The right graph shows a concentration-time curve where the concentration drops from 100 units to 50 units over a period of 4 hours, illustrating a half-life of 4 hours.

Plasma Drug Levels

- Steady State:** In pharmacokinetics, steady state refers to the situation where the overall intake of a drug is fairly in dynamic equilibrium with its elimination. In practice, it is generally considered that steady state is reached when a time of 4 to 5 times the half-life for a drug after regular dosing is started.

The graph plots concentration against time for multiple doses. Each dose causes a peak in concentration, and the troughs (minimum concentrations) between doses rise over time until they reach a constant level, known as steady state. The time taken to reach this level is approximately 4 to 5 half-lives.

What is your patient taking?

- Polypharmacy is not uncommon in our patient population, what are some of the common drug categories?




Patient related medication factors

Multiple factors place community dwelling older persons at risk of medication mismanagement. These include:

- Decreased comprehension of medication instructions and adherence.
- Living arrangements - in particular, older persons who live alone are more prone to medication errors
- Chronic diseases, particularly depression
- Physical limitations and [cognitive decline](#)
- Clinical complexity of care and treatment
- More than one prescribing provider
- Polypharmacy



3 Key Concepts

- Medication reconciliation is a formal process to create the most complete and accurate list possible of a patient's current medications and comparing the list to those in the patient record or medication orders.
- Medication adherence is the extent to which a patient's or caregiver's medication administration behavior coincides with medical advice.
- Medication knowledge involves patient comprehension, understanding, ability, and confidence in taking medications.

Patient compliance issues

- **Access:** How do you know when to get your medications refilled and how do you do it? Affordability?
- **Education/comprehension:** Does your pt. understand the medication and why it is prescribed?
- **Schedule:** Are there any medications that you have a hard time remembering to take and at what time?
- **Administration:** Do you use a pill box or organizer to help you take your medicines? Can they administer inhalers, patches, or injections if prescribed?
- **Behavioral Modifications:** would it work if you picked activities you do every day and take your medications at that time (e.g. read paper, eat meals)?

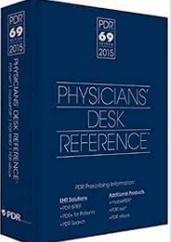
Trust but Verify

- Medication regime should be updated at each visit not just the first time.
- Keep in mind all patient related factors.
- Document any variance and re-educate as needed. Repetition is the key to adult learning.




How do I keep it all straight?

- The way we use to?
- 2000 pages
- Easy to use?
- Handy to carry?
- Got to get a new one every year?



Electronic reference make life easier,

- Online and apps make looking things up convenient and up to date.

Online	Phone app
https://www.pdr.net/	https://www.pdr.net/resources/mobilePDR/
https://www.drugs.com/	https://www.drugs.com/apps/
https://crediblemeds.org/healthcare-providers/drug-drug-interaction/	https://crediblemeds.org/blog/crediblemeds-launches-mobile-app-expand-access-online-gtdrug/
See next page	Pill Identifier and Drug list And picture ID (Smart Pill Finder), prescription pill finder

Pill Identifier

- <https://www.rxlist.com/pill-identification-tool/article.htm>
- <https://reference.medscape.com/pill-identifier>
- <https://www.drugs.com/imprints.php>
- CVS <https://www.cvs.com/drug>

References

- **Pharmacology for the Physical Therapist**
<https://accessphysiotherapy.mhmedical.com/book.aspx?bookID=442#40184139>
- Web MD <https://www.webmd.com/interaction-checker/default.htm>
- Credible Meds <https://crediblemeds.org/healthcare-providers/drug-drug-interaction/>
- CVS <https://www.cvs.com/drug>

Polling Question

- 4. The most accurate choice for quickly assessing an unidentified patient med is?
 - A. Hard cover PDR
 - B. Electronic drug web sites
 - C. Leave a message with the Physician's office
 - D. Ask a family member

Narcotic Pain Relievers

- Oxycodone, oxymorphone or morphine
- May be necessary for severe pain that does not respond to less potent pain relievers



Common opiate side effects are: nausea, loss of appetite, constipation, urinary retention, cognitive impairment, and respiratory depression



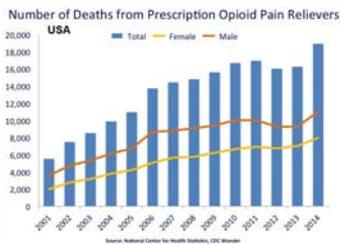
Opioid Interactions

- Post-operatively these are schedule II medications with a high potential for addiction and abuse they should not be combined with other Schedule II-V drugs
- Any medications or substances that depress Cardiac output, Respiration, and CNS function
- Alcohol, Sedating Antihistamines, Decongestants, Anxiety meds, Muscle Relaxers, Alpha blockers, Beta blockers, Alpha-Beta blockers, calcium channel blockers.
- Symptoms: delirium, loss of consciousness, cardiac and respiratory arrest.

Prescription Opioid Addiction

- The misuse of and addiction to opioids—including prescription pain relievers, heroin, and synthetic opioids such as fentanyl—is a serious national crisis that affects public health as well as social and economic welfare. The Centers for Disease Control and Prevention estimates that the total "economic burden" of prescription opioid misuse alone in the United States is \$78.5 billion a year, including the costs of healthcare, lost productivity, addiction treatment, and criminal justice involvement.
- Roughly **21 to 29** percent of patients prescribed opioids for chronic pain misuse them.
- Between 8 and 12 percent develop an opioid use disorder.
- An estimated 4 to 6 percent who misuse prescription opioids transition to heroin.⁷

Prescription Opioid Addiction



Naloxone/Narcan



Prescription Opioid Addiction

- **What is naloxone?** Naloxone is a medication designed to rapidly reverse opioid overdose. It is an opioid antagonist—meaning that it binds to opioid receptors and can reverse and block the effects of other opioids. It can very quickly restore normal respiration to a person whose breathing has slowed or stopped as a result of overdosing with heroin or prescription opioid pain medications.

Types of Naloxone



Orthopedic scenario 1

- 72 y/o female vegan with recent THA
- Put on Coumadin
- Put on OxyContin for pain

Meds prior to surgery

- Takes a “sugar pill” med
- Takes a baby aspirin
- Takes NSAIDs for OA
- Takes something for BP

Can't remember what the [pictured pills](#) are for?
Identify pills and possible interactions



Orthopedic scenario 1

- 72 y/o female vegan with recent THA
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Coumadin interacts with food (green leafy) ↓effect,
With ASA, NSAIDs ↑ effect, with diabetes med in hypoglycemia, Addiction risk with Oxy.

Glimepiride (Amaryl)

Nabumetone (Relafen)

Captopril (Capoten)



Orthopedic scenario 2

- 75 y/o male smoker, with recent second TKA
- Put on **Arixtra**
- Had nerve block and exparel for pain

Meds prior to surgery

- Takes a muscle relaxer
- Takes a fish oil capsule
- Takes NSAIDs for OA
- Takes a "water pill" for BP

Can't remember what the pictured pills are for?
Identify pills and possible interactions



Orthopedic scenario 2

- 75 y/o male smoker, with recent revision TKA
- Put on **Arixtra**
- Had nerve block and exparel for pain

Meds prior to surgery

- Takes a muscle relaxer
- Takes a fish oil capsule
- Takes NSAIDs for OA
- Takes a "water pill" for BP

Nicotine restricts blood flow interacts with BP med
Arixtra with NSAIDs and fish oil increase GI bleed
NSAIDs and Lasix ↑ risk of renal failure



Orthopedic scenario 3

- 66 y/o male with TKA R, s/p TKA L x 1 year
- Put on Coumadin
- Put on oxycodone
- Meds prior to surgery
- Takes a sleep aid
- Uses a pain patch
- Takes anxiety meds

The pt. is confused can't remember what the pictured pills are for? Identify pills and possible reaction.



Orthopedic scenario 3

- 66 y/o male with TKA R, s/p TKA L x 1 year
- Put on Coumadin
- Put on oxycodone
- Meds prior to surgery
- Takes a sleep aid
- Uses a pain patch
- Takes anxiety meds

Restoril® (Temazepam)

Duragesic (Fentanyl)

Fluoxetine (Prozac)



The pt. is confused can't remember what the pictured pills are for? Identify pills and possible reaction. High possibility he is having a reaction of the 3 pills combined with Oxy, may quickly lead to 911 call.

Questions??




Continuing Education Credits

Access the Rehab Summit Evaluation on August 1st:

- An email will be sent to your registered email address
- An evaluation link will also be available on RehabSummit.com

Once you have completed the evaluation, you can choose to print, download, or email the certificate for your records.

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