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Credits
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INTRODUCTION

If you lived 100 years ago, many aspects of your life would have been different. For starters, you could only expect to live (on average) about 50 years, compared to almost 80 years today. And unlike today, when people die of heart problems, cancer and other diseases of old age, you would have been more likely to die of tuberculosis, cholera, pneumonia or some other infectious disease. This was the era before antibiotics, so a burst appendix or a skin infection that became septic was often a death sentence.

This is not to say that there were no medical treatments. But they were attempts, and they were mostly unproven and ineffective. Some of the treatments were even worse than the disease. There was minimal regulation or oversight, so “quack cures” and adulteration of medications were common, and responsible for many deaths.

The era of modern medicine was ushered in almost 90 years ago, when Alexander Fleming, a scientist at St Mary’s hospital in London, noticed something odd in his laboratory. He had been studying bacteria by growing them in petri dishes and then examining the colonies. He found a discarded petri dish that was well colonized by bacteria – except in one area where a mold happened to be growing. The mold appeared to inhibit bacterial cell growth. Dr. Fleming isolated the active compound from the mold and confirmed that it killed bacteria. He called the compound penicillin because it originated from a group of molds called Penicilliums.

In spite of its promise, it still took over a decade for the active compound to be manufactured and put to use. That was the year 1943, and penicillin became available for the war effort, saving thousands of lives (WWII became the first major war in which deaths from trauma exceeded deaths from infection). This wonder drug was soon being used in civilian life, to treat everything from syphilis to pneumonia.

Learning Objectives

At the end of this overview, you will be able to:

- Describe pharmacodynamics and pharmacokinetics
- Describe the routes of drug administration and the importance of being able to apply the correct route of drug administration
- Describe the six rights of drug administration
- Identify the possible responses to drug administration
- Describe the different drug classifications
- Identify and describe medications that will be delivered or assisted
- Describe the special considerations when giving medications
WHAT IS PHARMACOLOGY?

**Pharmacology** is the overall study of drugs – how they are developed, how they act in the body, and what conditions they treat.

**Pharmacodynamics** addresses the way that drugs work in the body. Some drugs work by affecting the metabolism or actions of pathogens in the body, such as bacteria or fungus. For example, antibiotics such as penicillin poison bacterial cells without harming human cells.

Other drugs work by mimicking natural processes within the body, or by blocking these same processes. For example, opioid receptors in the brain respond to naturally produced compounds called endorphins that blunt the perception of pain or induce a feeling of well-being. Drugs such as morphine and heroin ("narcotics") are chemically similar to endorphins and can fit into the same receptor and elicit the same effect.

For Example:

Overdoses of these drugs can cause decreased level of consciousness, slow respiratory rate, apnea, and ultimately death. Paramedics treat narcotic overdoses with the drug naloxone (Narcan). This drug knocks the narcotic off the receptor and then blocks the receptor, preventing further action. An apneic overdose patient who is given narcan will often begin breathing and wake up.

**Pharmacokinetics** addresses how the body acts on a drug. Drugs are ultimately metabolized and eliminated from a person’s system through a variety of mechanisms including the lungs, liver, and kidneys.

What factors might affect this metabolism and elimination? One example is age. As people get older, the functions of their kidneys, liver, and other organs change. In many cases, the organs become less efficient at metabolizing and eliminating drugs. This means that the same drug in the same dose that the patient has been taking for years may circulate in the body for a longer period of time before being eliminated – thus having a greater effect.

For Example:

Consider an 80 year old woman who has been taking Vasotec, a common high blood pressure medication. You are called because she has had a syncopal episode. You find her lying in bed with a blood pressure of 90/60. Her normal blood pressure is 120/70. She also tells you that over the last few weeks, she has had several episodes of near-syncope and often feels lightheaded when standing.

As this patient’s renal (kidney) function has become impaired, the excretion of the drug has slowed, increasing its concentration in her body and causing an increased effect. Her doctor will need to adjust her medication to maintain her blood pressure at a normal level.
HOW ARE DRUGS ADMINISTERED?

There are many ways that drugs can be administered. Sometimes the route depends on where the drug acts. For example, many COPD patients take nebulized medications – drugs dissolved in water that are misted and inhaled. These drugs have a direct effect on the tissues of the airways and lungs.

In other cases, the route depends on the characteristics of the drug. Insulin is a protein. It can’t be given as a pill because the enzymes of the digestive tract would deactivate it. Insulin is given by injection.

Here are some of the many ways that drugs can be given. How many of these have you seen in the field?

<table>
<thead>
<tr>
<th>ROUTE</th>
<th>ILLUSTRATION</th>
<th>EXAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral (PO). By mouth. This is one of the least invasive methods of administering a drug, so many patients prefer it. However absorption of the drug may be slow and unpredictable.</td>
<td><img src="image" alt="Oral Route Illustration" /></td>
<td>Aspirin is often given by EMTs and paramedics.</td>
</tr>
<tr>
<td>Sublingual (SL). These medications are placed under the tongue and absorbed through the oral mucosa. Absorption can be very quick.</td>
<td><img src="image" alt="Sublingual Route Illustration" /></td>
<td>Nitro pills are placed under the tongue by patients. EMTs can assist patients with their nitro. Paramedics often give nitro spray sublingually.</td>
</tr>
<tr>
<td>Rectal (PR). This is sometimes the easiest way to give medications to an uncooperative child. Because the rectal mucosa is very vascular, absorption is usually rapid.</td>
<td><img src="image" alt="Rectal Route Illustration" /></td>
<td>Paramedics may give anti-seizure medications rectally to pediatric patients.</td>
</tr>
<tr>
<td>Intravenous (IV).</td>
<td>Most medications administered by paramedics are given IV.</td>
<td></td>
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<td></td>
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<tr>
<td>The medication is given through a catheter into a vein. The absorption is rapid and the drug has its effect very quickly.</td>
<td></td>
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<table>
<thead>
<tr>
<th>Endotracheal (ET).</th>
<th>Paramedics sometimes administer drugs through the endotracheal tube in a cardiac arrest situation if they have not established an IV. However, only certain drugs can be given via this route.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medications can be squirted down the endotracheal tube.</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intraosseous (IO).</th>
<th>Paramedics will often start an IO line if they are unable to quickly establish an IV, especially in a critical patient such as a cardiac arrest. Virtually any drug can be given through the IO route.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A large needle is drilled into the marrow of a patient’s bone. The bone marrow has direct communication with the circulatory system, so absorption of the drug via this route is very rapid.</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Intramuscular (IM).</th>
<th>EMTs administer epinephrine for anaphylaxis via the IM route.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medications are injected into the muscle where they are absorbed relatively quickly through small blood vessels in the muscle.</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Subcutaneous (SQ).</th>
<th>Diabetics inject themselves with SQ insulin. EMTs may occasionally give epinephrine SQ. In an extremely obese patient with a lot of subcutaneous tissue, the epinephrine needle may not reach the muscle.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medications are injected into the tissue between the skin and the muscle. Since there is less blood here than in the muscles, absorption is a little slower than the IM route.</td>
<td></td>
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</tbody>
</table>
Inhalation. Drugs are inhaled as a mist into the airways and lungs.

EMTs can assist patients with their nebulized medications. Paramedics may also administer medications through a nebulizer.

SIX “RIGHTS” OF DRUG ADMINISTRATION

Medical errors account for an estimated 210,000 to 440,000 deaths per year in the United States, a staggering number that ranks it in the top five causes of death. Some of these deaths are caused by errors in medication prescription or administration. Even errors that do not result in death often cause other health problems, longer hospital stays and slower recoveries. Documenting the number of these events is difficult, but a recent study, mandated by the US Congress and conducted by the Institute of Medicine, estimated that there are 1.5 million preventable adverse drug events per year.

EMS administration of medications can only be done on direct order from medical control or indirect order in the form of a protocol or directive. This is a privilege, and one that should not be taken lightly. While medications given in the field can be life-saving, errors in administering these medications have the potential for great harm. To reduce this potential risk, it is important to understand and adhere to the following “rights” of drug administration.

There are six “rights”— checks that must be done prior to actually giving a medication to a patient. Giving the wrong dose or the wrong drug can obviously have extremely serious consequences.

What are the six “rights?”

Right patient - Ensure that your patient meets the criteria for the drug and has no contraindications. For example, you would not give aspirin to a person who is allergic to aspirin, nor would you give oral glucose to a patient whose blood sugar reads “high.”

Right medication - Look at the medication and ensure it is the correct medication for the patient. This is especially important if you carry several different medications that look similar. Read the name of the medication on the package or vial.

Right dose - Confirm the correct dose according to your protocol, and administer that amount to the patient.

Right route - Administer the medication according to the proper route, whether it is oral (glucose), sublingual (nitro), or intramuscular (epinephrine).

Right time - Check the expiration date and make sure it is still usable. If it is a clear drug in a vial, such as epinephrine, check to make sure it is not cloudy or discolored; signs that would indicate the sterility of the vial has been compromised.

Right documentation - It is critical to document the presentation of the patient, what drug you gave, how you gave it, what time you gave it, and how the patient responded.
RESPONSES TO DRUG ADMINISTRATION

Most drugs, given properly to the appropriate patient, have the desired effect. Occasionally, patients can have an adverse reaction, even when the drug is administered correctly. Be alert to these reactions so that you can take further actions if needed.

Allergic reactions can range from a minor rash to anaphylaxis. Most patients are aware of their allergies, so it is critical to ask about allergies before administering any medication. Sometimes a person will have an unexpected allergic reaction to a drug that he or she has taken in the past.

Patients may also experience drug side effects, which are unintended and undesirable consequences of taking that drug. For example, intramuscular epinephrine when given for anaphylaxis has the desired effect of causing bronchodilation and vasoconstriction, helping to ease respiratory distress and treat hypotension. Undesirable side effects of epinephrine may include tachycardia, headache, and high blood pressure.

Sometimes drugs interact with each other to cause dangerous conditions, a reaction called potentiation. For example, EMS providers may assist patients with their nitroglycerin. However if the patient has taken the erectile dysfunction drug Viagra, or a similar medication, the nitroglycerin can cause a dangerous drop in blood pressure.

If the patient does have an unusual reaction to a medication that you have given or assisted in giving, make sure to document the reaction as well as advising medics or other health care providers.

DRUG CLASSIFICATIONS

Drugs fall into a number of different categories. Even if you’ve never heard of a particular medication, knowing what class it falls into will help you predict its effects. For example, if you know that a patient is taking a “beta-blocker,” you can predict that this medication will lower a person’s heart rate and blood pressure. Sometimes the name of a medication can provide clues to its actions. The generic names of many beta blockers have the suffix “olol.” Examples include metoprolol, propranolol, and labetalol. Other times, manufacturers choose a trade name that suggests how it is used. For example, the drug Restoril is a medication used for anxiety, while Elavil and Wellbutrin treat depression.

Many drugs are used for more than one purpose. Lyrica can be used to treat seizures, anxiety, and diabetic neuropathy. Ambien is used for insomnia but also restless leg syndrome. Beta-blockers may be used to treat hypertension but also certain types of anxiety.

The speed with which new drugs are introduced means that even the most experienced practitioners often have to look up the drugs that their patients are taking. Many EMS professionals carry small pocket guides for this purpose. Smart-phones apps are the latest innovation and often provide the most up-to-date information on prescription drugs.

Here are some categories of medications that you are likely to encounter:
# Central Nervous System Medications

These drugs include analgesics (drugs that treat pain), anti-anxiety medications, anti-seizure medications, and medications to treat psychiatric or psychological problems.

<table>
<thead>
<tr>
<th>TYPE/INDICATIONS</th>
<th>EXAMPLES</th>
<th>CASE STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Narcotic analgesics</td>
<td>Morphine, Hydrocodone, Codeine, Methadone</td>
<td>You respond to an 80-year-old female who has accidentally taken too many of her prescribed codeine pills. She presents drowsy and confused with a slow respiratory rate and pinpoint pupils. Medics respond and treat the patient with the narcotic antagonist Narcan (naloxone) which reverses the effects of the narcotic.</td>
</tr>
<tr>
<td>Anti-anxiety and sedative-hypnotics</td>
<td>Ativan, Librium, Valium, Xanax, BuSpar, Nembutal</td>
<td>A 30-year-old female has overdosed on several handfuls of her prescribed anti-anxiety medications, along with alcohol. You find her unresponsive with a decreased respiratory drive. You assist her ventilations with a bag valve mask until the paramedics arrive.</td>
</tr>
<tr>
<td>Anti-seizure</td>
<td>Tegretol, Neurontin, Lyrica, Topamax, Dilantin</td>
<td>A 35-year-old man is found post-ictal after a seizure. His vital signs are stable. As his level of consciousness improves, he tells you that he recently ran out of his prescribed Tegretol and could not afford to buy more. He is transported BLS for a checkup and to assist in obtaining his necessary anti-seizure medications.</td>
</tr>
<tr>
<td>Anti-psychotic</td>
<td>Seroquel, Abilify, Zyprexa, Lithium,</td>
<td>You are dispatched to a 50-year-old male with a history of bipolar disorder. He is agitated, anxious, and feels suicidal. He tells you that he is prescribed Abilify but stopped taking it without talking to his doctor, because he was feeling better. His vitals are stable. You arrange transport to the emergency room where he can receive psychiatric evaluation and treatment.</td>
</tr>
<tr>
<td>Anti-depressant</td>
<td>Wellbutrin, Effexor, Cymbalta, Cela,Lexapro, Paxil, Prozac, Zoloft, Elavil</td>
<td>A 30-year-old male is found unconscious with a pill bottle nearby of the tricyclic antidepressant Elavil. The bottle, which should have held 20 pills, is empty. The patient has a blood pressure of 80 and a heart rate of 140. Medics are requested for altered mental status and unstable vital signs. While many of the newer anti-depressants have a good safety profile, a few, such as this one, can be extremely dangerous if taken in overdose.</td>
</tr>
</tbody>
</table>
Cardiovascular System Medications

These include medications to lower blood pressure, treat problems with the heart rhythm, prevent clots, and treat high cholesterol. Some patients may be taking more than one medication even for a single problem such as high blood pressure or high cholesterol. High blood pressure may be addressed in many different ways, such as lowering the heart rate (beta blockers), promoting fluid excretion (diuretics) and causing blood vessels to dilate (ACE-inhibitors and calcium channel blockers).

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<th>TYPE/INDICATIONS</th>
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<tbody>
<tr>
<td>Anti-hypertensives</td>
<td>Beta-blockers: Breviblock (esmolol); Inderal (propranolol); Coreg (carvedilol) Diuretics: Lasix (furosemide), hydrochlorothiazide Vasodilators (several different mechanisms): Vasotec (enalopril), Zestril (lisinopril), Norvasc (amlodipine), Cardizem (diltiazem)</td>
<td>You are evaluating a 65-year-old man who has been involved in a serious motor vehicle accident and is complaining of right upper quadrant pain. He tells you that he takes atenolol, a beta blocker, for high blood pressure. The patient’s blood pressure is 100P. Given his pain and the mechanism of injury, you are concerned about shock. However his heart rate is only 60. You recognize that a patient taking a beta blocker to lower his heart rate may not have the tachycardia that you would expect in the face of blood loss.</td>
</tr>
<tr>
<td>Antiarrhythmics</td>
<td>May include beta blockers and vasodilators (above) as well as Digoxin (digitalis)</td>
<td>A 75-year-old man has called complaining of heavy, substernal chest pain. His blood pressure is 130/90. His heart rate is 140 and irregularly irregular. He tells you that he has a history of atrial fibrillation but has not been taking his prescribed medication (Digoxin). Paramedics respond to evaluate his chest pain and treat his rapid heart rate.</td>
</tr>
<tr>
<td>Anticoagulants</td>
<td>Coumadin (warfarin), Pradaxa, Xarelto</td>
<td>An 80-year-old woman has fallen and hit her head. She is awake with stable vital signs and complaining of a headache. She has a history of atrial fibrillation, which has been well controlled. Because of her atrial fibr, she takes Warfarin, an anti-coagulant, to prevent stroke. The anti-coagulant increases her risk of serious bleeding, so even though her fall was minor, she needs to be evaluated in the emergency room.</td>
</tr>
<tr>
<td>High cholesterol</td>
<td>Statins: Lipitor, Mevacor, Crestor, Zocor Niacins: Nicolar, Niaspan</td>
<td>Your patient is a 50-year-old female who describes a heaviness in her chest and states that she “can’t catch her breath.” She has no cardiac history but takes Lipitor for high cholesterol. Her high cholesterol puts her at risk for cardiac disease, and her symptoms are concerning. You request a medic unit for an evaluation.</td>
</tr>
</tbody>
</table>
Respiratory System Medications

These include medications for the treatment of asthma and COPD. Some emergencies that present with shortness of breath, such as CHF, are actually caused by cardiac problems, so are treated with cardiac medications such as anti-hypertensives.

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<th>TYPE/INDICATIONS</th>
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<tbody>
<tr>
<td>Bronchodilators</td>
<td>Albuterol, Atrovent, Ventolin, Alupent, Advair, Symbicort</td>
<td>A 25-year-old female calls for shortness of breath. She is barely able to speak, but tells you that she has a history of asthma. She uses a Combivent inhaler, but is too short of breath to walk to the bathroom to get it. You retrieve the inhaler and assist her in using it. Her shortness of breath improves dramatically by the time the medic unit arrives.</td>
</tr>
<tr>
<td>Steroids</td>
<td>Solu-medrol, Decadron, Methylpred</td>
<td>A 75-year-old man with a history of COPD recently returned from the hospital where he was treated with high dose steroids. He has very thin, fragile skin with multiple bruises – a side effect of the medications he is taking.</td>
</tr>
<tr>
<td>Cough and cold</td>
<td>Various combinations of over-the-counter medications</td>
<td>A 16-year-old female calls you for a “rapid heart rate.” She has been sick with a cold and has taken several doses of over-the-counter cold medication. Her blood pressure is 110/80 and her heart rate is 120. You check the package and note that one of the ingredients is caffeine. Your patient admits to also drinking one Red Bull. The combination probably accounts for her increased heart rate.</td>
</tr>
</tbody>
</table>
**Gastrointestinal System Medications**

These include medications to prevent or treat ulcers and reflux as well as nausea and vomiting.

<table>
<thead>
<tr>
<th>TYPE/INDICATIONS</th>
<th>EXAMPLES</th>
<th>CASE STUDY</th>
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</thead>
<tbody>
<tr>
<td>Peptic ulcer disease, reflux</td>
<td>Prilosec, Zantac, Prilosec, Zantac, Prevacid, Pepcid</td>
<td>You are evaluating a 45-year-old male who states he feels lightheaded. You find that his blood pressure is 120/90 when lying flat, but 80/50 when sitting up. You recognize that one of his medications is Pepcid, which he takes for ulcers. He also tells you that his stools have been unusually dark. His presentation, history, and meds suggest that he may have an active GI bleed.</td>
</tr>
<tr>
<td>Nausea, vomiting</td>
<td>Zofran, Phenergan</td>
<td>You are assisting paramedics in their treatment of a 45-year-old acute MI. The paramedics have given morphine for the patient’s chest pain. Shortly thereafter, the patient begins to complain of nausea. To counteract the nausea, the medics administer a drug called Zofran.</td>
</tr>
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**Endocrine System Medications**

These include medications that either block or mimic naturally occurring hormones in the body. The most commonly used endocrine system medications are drugs that treat type 1 and 2 diabetes, which is a disorder in the way that the pancreas produces insulin.

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<tr>
<th>TYPE/INDICATIONS</th>
<th>EXAMPLES</th>
<th>CASE STUDY</th>
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</thead>
<tbody>
<tr>
<td>Thyroid</td>
<td>Synthroid, Levothyroxine</td>
<td>You are evaluating a 3-year-old female who has found a pill bottle belonging to her grandmother and consumed an unknown number of pills. The pills were Synthroid, a thyroid replacement that can cause hypertension, tachycardia and seizures when taken in overdose. Medics are requested for evaluation and treatment.</td>
</tr>
</tbody>
</table>
| Pancreas | Insulin: (Humalog, Novalog, NPH, Humulin) reduces blood sugar levels  
Glucagon: increases blood sugar levels  
Oral diabetic medications: (Glucophage, Glipizide, Diabeta) reduce blood sugar levels | A 35-year-old female is found mumbling incoherently in bed by her husband. She is an insulin-dependent diabetic. He checks her blood sugar and finds it to be 20. He calls 911, but while awaiting the arrival of EMS, he locates her prescribed glucagon, a naturally occurring hormone that promotes the release of glucose by the body. He injects the glucagon as prescribed. The patient is just beginning to wake up as you arrive. A recheck of her blood sugar shows it at 212. |
Reproductive

Viagra, Cialis (erectile dysfunction)
Premarin, Estrogel (estrogen replacement)

A 55-year-old male called complaining of chest pain which is worse than his normal angina. He does have a prescription for nitro, but he hasn’t taken it for this episode. Before assisting your patient with his nitro, you remember to ask whether the patient has used any erectile dysfunction meds in the last 36 hours. He says “yes,” so nitro is contraindicated since it may cause a dangerous drop in blood pressure.

Medications to Treat Infectious Disease and Inflammation

These include medications to treat infection and inflammation. Some of these drugs destroy the infection-producing agents (bacteria, fungus) while others provide symptomatic relief.

<table>
<thead>
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<th>TYPE/INDICATIONS</th>
<th>EXAMPLES</th>
<th>CASE STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antibiotics</td>
<td>Zithromax, Amoxicillin, Levaquin, Keflex</td>
<td>You are evaluating an 80-year-old male in a nursing home. Staff called because of an altered mental status. The patient presents unresponsive with a BP of 70P, HR of 140, a fever, and jumpy sounding lungs. Staff tells you that the patient recently finished a course of Zithromax, an antibiotic. It is likely that the antibiotic did not completely eradicate the harmful bacteria, and when the antibiotic was stopped, the infection returned.</td>
</tr>
<tr>
<td>Anti-inflammatory</td>
<td>Aspirin, Acetaminophen, Naproxen, Ibuprofen</td>
<td>A 60-year-old female calls complaining of a chest tightness and mild nausea. Her vital signs are stable. While waiting for the medic unit and after ensuring that there are no contraindications, you administer 4 baby aspirin for her possible cardiac discomfort. In this case, the aspirin is given because it helps prevent blood clots from forming and may reduce the size of those that have already formed.</td>
</tr>
</tbody>
</table>
FIELD PHARMACOLOGY

EMTs, depending on their local policies and guidelines, may carry a limited number of medications. They may also assist patients with their own medications. In this section, we’ll explore the most common medications that EMTs either administer or assist in giving.

**BLS MEDICATIONS**

<table>
<thead>
<tr>
<th>Medication</th>
<th>Example</th>
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</thead>
<tbody>
<tr>
<td><strong>Aspirin</strong></td>
<td>Example: 50-year-old male complaining of chest pain that started about 15 minutes prior to calling. The patient also states he feels slightly short of breath, but has no other complaints. His vitals are BP 130/80, HR 88, RR 16. His skin is cool and damp. He has no significant medical history, takes no medicine, and has no allergies. After confirming that the patient has no allergies and no contraindications, you administer 325 mg of aspirin (one adult aspirin or 4 baby aspirin)</td>
</tr>
<tr>
<td><strong>Epinephrine</strong></td>
<td>Example: 16-year-old female states she feels “dizzy” after eating the school lunch. She also states her body feels itchy all over. Patient’s vital signs are BP 70P, HR 130, RR 22. Her skin is hot, dry, and covered with hives. Her lung sounds are clear and equal. She has allergies to peanuts but no other medical history. She has a prescription for an epi-pen but doesn’t have it with her. After confirming that the patient has no allergies and no contraindications, you administer an adult dose (0.3 mg) of epinephrine.</td>
</tr>
<tr>
<td><strong>Glucose</strong></td>
<td>Example: 26-year-old male is found by wife confused and disoriented. He was reportedly fine an hour prior. There are no signs of injuries and his physical exam is unremarkable. His vitals are BP 112/70, HR 110, RR 18. His blood sugar is 45. The patient has a history of type 1 diabetes and takes insulin. His wife isn’t sure when he last ate or took his insulin. After confirming that there are no contraindications, you administer a tube of oral glucose gel. Within 10 minutes, the patient’s level of consciousness improves and his repeat blood sugar is 175. The patient declines transport to the hospital. His wife will stay with him and ensure that he eats. He will follow up with his private MD.</td>
</tr>
<tr>
<td><strong>Oxygen</strong></td>
<td>Example: You are evaluating a 70-year-old male with a sudden onset of left-sided weakness and slurred speech. He denies headache or other complaints. His physical exam is unremarkable except a facial droop and asymmetric weakness. His blood pressure is 130/90, HR 72, RR 14. His oxygen saturation on room air is 98%. New research suggests that stroke patients with normal room air saturations do not benefit from, and may even be harmed by, supplemental oxygen.</td>
</tr>
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New research suggests that stroke patients with normal room air saturations do not benefit from, and may even be harmed by, supplemental oxygen.
BLS ASSISTED MEDICATIONS

Nitroglycerin

Example: You are evaluating a 50-year-old man with a history of angina. He called complaining of chest pain radiating to his left arm. His vitals are BP 136/80, HR 80, RR 18.

Your patient has a prescription for nitro, but hasn’t taken any. He has no contraindications. You retrieve the patient’s nitro from the bathroom, open the container, and offer it to him. You ensure that he is seated.

After two nitro, taken 5 minutes apart, the patient’s pain has subsided. The medic unit arrives and finishes the evaluation.

Inhalers

Example: You are seeing a 72-year-old female with a history of COPD who calls complaining of increased shortness of breath over the last two days. She has also had a fever and a productive cough. Her vitals are BP 150/90, HR 96, RR 28. Her lungs have wheezes in all fields.

The patient normally takes an inhaler, but states she is too short of breath to find it. She thinks it is in her bedroom.

You find the inhaler and bring it to the patient. She uses the inhaler and has some relief. The responding medic unit arrives and continues her evaluation and care.

SPECIAL CONSIDERATIONS

EMTs are often faced with situations in which a patient’s prescription medications may influence their treatment or transport decisions. In this section we’ll review a few of these situations.

Anticoagulants

Anticoagulants are medications that reduce the clotting ability of the blood. There are many reasons that a patient might be given anticoagulant medications. Some of the more common are to prevent deep vein thrombosis (DVT) and pulmonary embolus. Patients with artificial heart valves and patients who are in atrial fibrillation are also anticoagulated to prevent clots that could travel to the brain and cause a stroke.

The most common medical anticoagulant used today is Warfarin (Coumadin). It works by inhibiting the body’s recycling of Vitamin K, which is required as part of the clotting process.

Although administration of anticoagulants can be lifesaving in preventing strokes and other complications, there is also an inherent danger. Patients who suffer relatively minor trauma can have life-threatening bleeding since their clotting ability is impaired.

For this reason, it is imperative to ask about medications that a patient is taking. An older person who takes Coumadin for her atrial fibrillation and suffers a blow to the head from a minor fall may have significant bleeding. Since the bleeding may be slow, the patient may not present with any alteration in mental status or vital signs. It is impossible for the EMS professional to evaluate ongoing internal bleeding in the field except by being aware of mechanism of injury. Furthermore, patients on anticoagulants are prone to other bleeding problems, such as GI bleeds, and are more likely to bleed after relatively minor trauma such as a car accident.
Any patient on an anticoagulant who suffers a trauma should be evaluated in the hospital. If the patient is found to be bleeding, the anticoagulant effect can be reversed in the hospital by administering large doses of Vitamin K.

However, as medicine continues to evolve, so do medications. Newer anticoagulants act on different parts of the clotting cascade. Examples of these medications, which EMTs now are beginning to see in the field, are Pradaxa (dabigatran) and Xeralto (rivaroxaban). These medications have the advantage of requiring less precise control and fewer blood tests than Coumadin. However, because they have a different mechanism of action, Vitamin K does not reverse the anticoagulant effect. In fact, there is currently no antidote to reverse the effect in the case of significant bleeding. Maintaining an index of suspicion and having a low threshold for transport even in the case of minor trauma is key to treating patients on anticoagulants.

**ACE-inhibitor Angioedema**

ACE-inhibitors are a class of anti-hypertensive medications that include many drugs ending in “pril” such as Enalapril, Captopril, and Lisinopril. Rarely, a patient taking these medications may experience swelling of the lips and tongue. This may occur for no apparent reason even in a patient who has taken the medication for many years. The swelling may be minor or may progress to the point where the tongue protrudes from the mouth and the airway is affected. Even minor swelling requires evaluation since it may worsen; any rapidly increasing swelling, changes in voice, or respiratory distress are an ALS response. While this is not a typical allergic or anaphylactic reaction (hives, wheezes, and hypotension are usually absent), if there is respiratory distress and the patient meets other criteria, the EMT can administer epinephrine.

**Anti-Diabetic Medications**

EMTs often see insulin-dependent diabetics whose blood sugar is low because they have forgotten to eat or because they inadvertently injected too much insulin. If the person is coherent enough to swallow, EMTs may administer oral glucose. If the person regains a normal level of consciousness, has a normal blood sugar, and is able to eat, he or she may request to stay home with family or caregiver instead of being transported to the hospital. EMTs typically instruct the patient to follow-up with his or her physician.

This approach of treating and leaving hypoglycemic patients at home should only be considered in patients who are insulin-dependent diabetics with insulin as their only diabetic medication.

Hypoglycemia can also occur, but less commonly, in diabetics who take no insulin, or who take insulin in combination with oral diabetic medications. More rarely, people with no history of diabetes can develop hypoglycemia secondary to illness, medications, or other conditions. All of these patients must be evaluated by a physician and should not be left at home by the EMT, even if their blood sugar has returned to normal and they are now alert. These patients have more complicated causes for their hypoglycemia; you may have temporarily reversed their hypoglycemia but they are at risk for another episode. The cause of their hypoglycemia must be investigated further.

**Bystander-administered Naloxone for Narcotic Overdose**

In June 2010, Washington State’s 911 Good Samaritan Law (RCW 69.50.315) went into effect. This law provides immunity from criminal charges for people who witness a drug overdose and seek medical help. The law also expands access to the drug naloxone (Narcan), which reverses the
effects of narcotic opiates such as heroin. Friends or family members of people who are at risk of overdosing, such as users of heroin, may obtain a prescription for this drug.

The primary risk of death in narcotic overdoses is hypoxia resulting from apnea. Naloxone reverses the respiratory depressant effect of the narcotic. The goal is for the person to start breathing again and wake up. Naloxone has few side effects other than reversing the effects of the narcotic. In addition to waking up and beginning to breathe again, the patient may experience symptoms of withdrawal such as vomiting or shivering. Narcan only works on narcotic overdoses and will not reverse the effects of other drugs.

Friends and family members of narcotic users (called “bystanders” in the law) may obtain a prescription for either intranasal or IM narcan. If you arrive on the scene of such a situation, you may assist bystanders in administering their narcan to an unresponsive patient.

Since bystanders are advised to call 911 even after giving the medication, you may also encounter a patient who is waking up after having been given narcan by friends or family. Narcan typically lasts about an hour and some narcotics last much longer, so even a patient who is awake and breathing should be observed in an emergency room.

Lastly, many patients who overdose on narcotics have injected themselves with heroin or other injectable drug. Be especially careful of sharps when working around these patients.

For more information, see: http://www.stopoverdose.org/

**ALS MEDICATIONS**

Paramedics carry a wide variety of different medications to treat everything from post-partum hemorrhage to seizures. Perhaps you’ve seen these medications being administered, and wondered what they were or how they acted.

**Intravenous Fluids**

Many ALS medications are given intravenously (IV) because the onset of action is very rapid. To access the venous circulation, a needle and catheter are inserted into the vein. The needle is withdrawn and the catheter stays in the vein. To keep blood from clotting around the catheter, IV solution is dripped into the vein. Most ALS systems carry two types of IV solutions:

- **D5W** - This is a dilute sugar (dextrose) solution.
- **Ringers or normal saline** - This is a dilute salt or salt/electrolyte solution

Patients who are hypotensive from fluid loss need IV fluids; Ringers or normal saline are used for this situation. D5W can be used for hypoglycemic diabetic patients or others who don’t need a lot of volume replacement. Paramedics may ask EMTs to assist in setting up IV bags, but they should always tell the EMT which type of solution to use.

**Field Medications**

Medications will be administered in the field for different reasons and in a potentially different sequence each time.
Case Study 1:
You are responding with paramedics to a 60-year-old male sudden collapse. When you arrive, you begin 2 minutes of high-quality CPR. The paramedics arrive just as you are finishing your cycle. They start an IV of Ringer’s lactate and intubate the patient. Rhythm analysis says “shock advised.” You provide one shock and resume high-quality CPR. Over the next few minutes, the paramedics administer epinephrine and lidocaine. After two more minutes of CPR, you stop compressions and find the patient in a perfusing rhythm with a BP of 70P and a heart rate of 40. Paramedics administer atropine and the heart rate increases to 72 with a repeat blood pressure of 120P. As you prepare to package the patient for transport, he begins taking some breaths on his own and starts to move his arms and legs. The paramedics quickly sedate the patient with midazolam and morphine.

- **Epinephrine**: Helps stimulate the heart, improves the effectiveness of CPR
- **Lidocaine**: May help reduce the irritability of the heart
- **Atropine**: Increases the heart rate
- **Midazolam**: Sedates the patient
- **Morphine**: Provides pain control

Case Study 2:
You are dispatched to a “man down” in the alley. Bystanders found a 30-year-old male, apneic, unresponsive, with pinpoint pupils, lying face-down in a pool of vomit, unknown downtime. You turn the patient over, begin to ventilate and suction him, and await the arrival of paramedics. The patient’s vital signs are: BP 130/80, HR 130, R 0 before being ventilated. Blood sugar is 103. Pulse ox is 80. Lung sounds are junky throughout. Paramedics arrive, start an IV of normal saline, and administer narcan. After the narcan, the patient begins to withdraw from painful stimuli but does not awaken. Vitals signs remain the same, though the patient makes occasional gasps. Since the patient cannot adequately protect his airway, the paramedics administer succinylcholine and intubate him. They then administer norcuron and transport to the emergency room.

- **Narcan**: Reverses the effect of narcotic medications such as heroin
- **Succinylcholine**: Provides short-term paralysis so paramedics can intubate a patient
- **Norcuron**: Provides long-term paralysis so paramedics can ventilate a patient