Pharmacology and Drug Administration

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Scenario
Male with Chest Pain

Vitals @ 1005
HR = 90
RR = 24
BP 150/84
O2 by NC 4 lpm
324 mg ASA @ 1010
Oral administration
Scenario
Male with Chest Pain

Great report. We're going to start an IV, do a 12 lead ECG, and treat from there.

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Pharmacology
Introduction

Why are drugs administered by different routes?

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Objectives
Pharmacology

- Review basic pharmacodynamics and pharmacokinetics
- Explore essentials of drug administration
- Discuss the indications and use of specific medications
Pharmacology
Science that deals with drugs

Medications
Cure specific illnesses

Drugs
Aid in diagnosis, treatment, or prevention of any disease

Objective 1: Pharmacokinetics and Pharmacodynamics

Pharmacology
(study of drugs and their actions on the body)

Pharmacokinetics
Pharmacodynamics

Pharmacology
Definitions

Pharmacokinetics
How drugs get into and out of our body

Pharmacodynamics
How drugs affect our body and take effect
### Drug Names

Four names for every drug

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Albuterol</th>
<th>Aspirin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Official Name</td>
<td>Albuterol</td>
<td>Aspirin</td>
</tr>
<tr>
<td>Generic Name</td>
<td>Albuterol sulfate</td>
<td>ASA</td>
</tr>
<tr>
<td>Trade Name</td>
<td>Ventolin®</td>
<td>Bayer® Aspirin</td>
</tr>
</tbody>
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### Pharmacokinetics

One branch of pharmacology

- Transport into, around, and excreted from body

### Routes of Entry

Injection, absorption, inhalation, ingestion

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Enteral Drugs
Ingested drugs that enter GI Tract

Other Routes
Per rectum
G-tube

Enteral Drugs
Always water soluble

Water solubility improves drug’s ability to survive acidic environment inside stomach

Parenteral Drugs
Does not pass through GI tract first

Most drugs used by prehospital providers
Rate of Onset
Drug eventually needs to reach bloodstream

Comparison of Routes
Time to peak effect

<table>
<thead>
<tr>
<th></th>
<th>Morphine</th>
<th>Diazepam</th>
<th>Fentanyl</th>
<th>Nitroglycerin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topical patch</td>
<td>1.1-5 hrs</td>
<td>n/a</td>
<td>24 hr.</td>
<td>30-120 mins</td>
</tr>
<tr>
<td>Oral pill / tablet</td>
<td>1 hr</td>
<td>1-2 hrs</td>
<td>n/a</td>
<td>45-120 min (extended release)</td>
</tr>
<tr>
<td>IM Injection</td>
<td>0.5-1 hr</td>
<td>0.5-1.5 hrs</td>
<td>20-30 mins</td>
<td>4-8 mins (sublingual)</td>
</tr>
<tr>
<td>IV Injection</td>
<td>0.3 hr</td>
<td>15 min</td>
<td>3-5 min</td>
<td>immediate</td>
</tr>
</tbody>
</table>

Distribution
A drug reaching its target cells
Therapeutic Effect
Intended action of the drug

Binding with albumin increases action time

Crossing Cell Membranes
Most drugs cross via passive transport

Active transport requires energy

This slide is a placeholder for Engage Media
Elimination Routes
Drugs are removed like other body toxins

- Fecal material
- Exhalation
- Urine

Biotransformation
Changing drug to different chemical structure

- Pills
- GI Tract
- Portal Vein
- Hepatic Vein
- Hepatic artery
- Systemic Circulation

Because of first pass effect some drugs given IV

Pharmacodynamics
Affect of drug on body

- Drug is at the target cell
- but now what?
**Drug Actions**

Four types

1. Bind to a receptor site
2. Change a cell’s physical properties
3. Chemically combine with other cells
4. Alter our normal metabolic pathways

**Receptor Site Binding**

Stimulates or inhibits a cellular process

- Stimulated or inhibited
- Target Cell
- Pain inhibited

**Drug Affinity**

Force of attraction to receptor site

- Morphine has greater efficacy
- Nubain has a much stronger affinity
Changing Physical Properties
Not commonly used in prehospital care

Fibrinolytics
Break-up clots

Chemical Combination

Antacid

Altering Metabolic Pathways
Anticancer and antiviral drugs
Objective 2: Administration Essentials

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Objective 3: Indications & Administration

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Respiratory Distress
Child playing at park

- "wind knocked out" - Asthma
- Anaphylaxis - Anxiety

Respiratory Distress
History of asthma

- Wheezing
- Speaks in phrases
- Running when started
- Hx of asthma
- MDI at home

Asthma
Inspiratory and expiratory wheezes

- Normal Airway
- Asthmatic Airway

Opening bronchi is only part of management
Albuterol
Preferred bronchodilator for prehospital care

Treatment
2.5mg albuterol via nebulizer mask

Corticosteroid
Helps to reduce swelling

Treatment
125mg IV

Long-time to peak effect; administer early
Chest Pain
57 y.o. male

57 y.o. Chest pain
Pale, diaphoretic
Heaviness, worsening
25 minutes
8/10 pain
Previous MI

Question: Based on the available information which of the following is MOST likely the patient’s problem?

1.) Myocardial infarction – correct
2.) Heartburn
3.) Anaphylaxis
4.) Asthma

Feedback (pass or fail)
All available signs and history information point to a Heart Attack
Aspirin (ASA)
Platelet inhibitor interrupts clotting process

Aspirin keeps the clot from getting bigger

How does ASA specifically work?

MONA
Four medications for MI patients

Morphine
Oxygen
Nitroglycerine
Aspirin

EMT-Basics

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Nitroglycerin
Smooth muscle relaxant

- Reduces cardiac output by reducing blood pressure
- Dilates all blood vessels
- Effects wear off quickly
- Paramedics may consider alternative forms
- Reassess patient’s pain and vitals after each administration

Nitroglycerine Alternatives
Sub-lingual spray, paste, or drip

- ⅛" paste
  - NT Paste = 7.5 mg over 6 hours or 20.8 mcg/min
  - 1 spray every 5 minutes
- NT Spray = 80 mcg/min

Chest Pain Lessening
57 y.o. male

Great report. We’re going to give nitro, morphine, and capture a 12 lead.
Nitro Drip
50 mg in 250 mL of D5W

200 mcg/mL
More effective at pain relief
Begin at 5 mcg/min. Titrate to effect
Follow local protocols for administration

Allergic Reaction
Female with known allergy history

Allergic Reaction
Respiratory distress, swelling, & hives

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### Anaphylaxis Treatment
Rapid administration of epinephrine

- **Pulse**: 138
- **Respirations**: 32
- **Blood pressure**: 84/56
- **Skin**: flushed, moist, warm
- **She is awake but lethargic**

### Anaphylaxis
ALS and BLS treatments

- **BLS Treatment**
  - Epi pen
  - **O2 @ 12 lpm**

- **ALS treatment**
  - **IV NS 0.9%**
  - 50 mg diphenhydramine

### Epinephrine
Reverses effects of anaphylaxis
Epinephrine
Available in multiple forms

- Natural catecholamine
- Also known as adrenaline
- Stimulates adrenergic receptors

Diphenhydramine
Delivered IM, IV, or oral

Dose is 25-50 mg  Onset depends on delivery route
Altered Mental Status
62 y.o. male with extensive medical history

- Breathing V on AVPU
- Diaphoretic skin
- Sluggish pupils
- HR = 68, RR = 14
- BP = 132/60
- Hx: stroke, MI, DM, HTN, DVTs, UTIs

After Glucagon
Patient improving; airway patent

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**Glucagon**

Breaks down glycogen into glucose

Give when IV access can not be established

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**Accidental Overdose**

19 y.o. female patient

**Awake**

Oriented, anxious

Accidental overdose

Chronic low back pain

15 vicadin tablets

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**Accidental Overdose**

Unremarkable findings; at this time

**HR = 96**

**RR = 14**

**BP = 136/68**

Skin: moist, pink, warm

This is a dangerous overdose
Question. As you and your partner discuss treatment options the patient begins to complain of feeling light headed, weak, and dizzy. It is a 20 minute transport to the emergency department.

Answers
1.) Simply transport the patient
2.) Encourage or induce vomiting
3.) Administer activated charcoal.

Pass/fail feedback
Administer charcoal to limit absorption of the drugs. Inducing vomiting creates an aspiration risk.

Medicine is Dynamic
Change is constant so keep an open mind

Know and follow your local protocols
Summary
Pharmacology and Drug Administration

- Pharmacokinetics and pharmacodynamics explains how drugs work
- Rate of onset and time to peak effect is partially determined by its route of entry
- Use ‘6’ rights mnemonic to ensure proper administration
- Use patient assessment to determine problem and choose appropriate drug
- Treatment for many problems begins with excellent BLS assessment and drug administration

Credits
Pharmacology and Drug Administration

<table>
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<tr>
<th>Lesson Author</th>
<th>Kevin T. Cologny, BA, NREMT-P, WEMT</th>
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<tbody>
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<td>Lesson Reviewer</td>
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</tr>
<tr>
<td>Design and Production</td>
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                      | Kenny Navarro
                      | KyleDavidBates.com
                      | LifeART
                      | NCI Visuals Online |
| Narrator            | Laura A. Glass                   |

References
Pharmacology and Drug Administration

Drug Card References: