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- Email customerservice@PhysicalTherapy.com
Geriatric Pharmacology: PT Role and Responsibilities

By: Jill Heitzman, PT, DPT, PhD
Board Certified Geriatric Clinical Specialist, Board Certified Neurological Clinical Specialist, Clinical Wound Specialist, Certified Exercise Expert for Aging Adults, Advanced Credentialed Exercise Expert for Aging Adult
Maryville University, St. Louis, MO

Learning Outcomes

Following this course, participants will be able to:

- Identify at least two aspects of the role of the PT in managing pharmaceutical interventions for aging adults.
- Define impact of pharmaceutical interventions on the PT Plan of Care.
- Accurately differentiate between the adverse side effects with normal physiological aging versus common pathologies seen in the aging population.
- Identify at least three needs for referral to other health care providers based on pharmaceutical interventions/side effects.
- Provide at least two resources to educate the aging adult on issues related to their pharmaceutical profile and polypharmacy.
Medications and Older adults

General Statistics

- Medications are involved in 80 percent of all treatments and impact every aspect of a patient’s life.
- Medicare beneficiaries with multiple chronic illnesses see an average of 13 different physicians, have 50 different prescriptions filled per year, account for 76 percent of all hospital admissions, and are 100 times more likely to have a preventable hospitalization than those with no chronic conditions. (APTA, 2013a; Kantor et al, 2015)
Medication Management

- Performing patient assessment
- Comprehensive medication review
- Formulating a medication treatment plan
- Monitoring efficacy and safety of medication therapy
- Enhancing medication adherence through patient empowerment and education
- Documenting and communicating MTM services to prescribers in order to maintain comprehensive patient care

(Reidt, et al 2016; Shah et al 2013)

Physical Therapy and Medications
Dr. Jules Rothstein

- “Therapists can no longer afford the luxury of considering their efforts independent of other practitioners
- How can anyone evaluate the care given to patients with low back pain when physical therapy and medications are used simultaneously?
- How can we exercise patients unless we understand cardiac function or metabolism might be influenced by their medication?”

Pharmacology Monograph, APTA, 1995

Dr. Charles Ciccone

- Most, if not all, patients who are receiving therapy are also receiving some kind of pharmaceutical intervention.
- Drug therapy can have synergistic/antagonistic goals to therapy, be taken for a pathology not related to the treatment of therapy, yet be both affected by and have an effect on therapy.
- Exercise and the application of physical agents and massage can affect the pharmacokinetics of a drug.
- Therapy interventions seem to have the greatest potential to affect absorption and distribution of drugs that are administered by trans dermal techniques or by subcutaneous and intramuscular injection. (Ciccone, 1995)
APTA HOD Statement

- Physical therapist patient/client management integrates an understanding of a patient's/client's prescription and nonprescription medication regimen with consideration of its impact upon health, impairments, functional limitations, and disabilities. The administration and storage of medications used for physical therapy interventions is also a component of patient/client management and thus within the scope of physical therapist practice.

APTA, 2013b

Normative Model of Physical Therapist Professional Education: Version 2004

- Pharmacology is a primary content area and includes:
  - Pharmacokinetic principles
  - Dose-response relationships
  - Administration routes
  - Enhancement of transdermal drug absorption
  - Absorption and distribution
  - Biotransformation and excretion
  - Factors affecting pharmacokinetics
  - Potential drug interactions
  - Pharmacodynamics
Guide to Physical Therapist Practice

- Medications are gathered from the patient/client history.
  - medications for current conditions
  - medications previously taken for current conditions
  - medications for other conditions.

OTHERS

- CAPTE: Standard 7A
- FSBPT: Analysis of Practice 2018
- CMS: In 2009, clearly stated PT could collect and review medications on OASIS
- JCAHO: 2015 Ambulatory Care National Patient Safety Goals & Quality ID #130 (NQF 0419): Documentation of Current Medications in the Medical Record
Challenge

- State Practice Act Variations
  - Most are silent on this topic
  - Most require unlicensed persons to administer only under DIRECTION of Nurse or Physician
    - Facilities have specific policies/procedures on this
    - States may also have specifics on self administered meds
  - Some state PTs can monitor medications as per the CMS

Since 2012

- Some states have made changes to include PT able to:
  - Administer topicals/aerosals under Prescription order
  - Complete a drug regime as per Oasis but refer questions to nursing or physicians
  - Provide basic education on medications related to PT POC only
- Some states have become MORE restrictive

****Major issue of discussion at FSBPT annual conference November 2017
Impact on PT POC

Potential Interactions Between PT Interventions & Therapeutic Drugs

- Physical Agents:
  - Ultrasound
  - Electrical Stimulation/TENS
  - Hot packs
  - Cold packs
- Massage
- Exercise
  - All forms: physical activity, balance, aerobic, flexibility, strengthening, gait/mobility
- Cognitive Function

(Ciccone, 1995)
International Classification of Function (ICF)

- Linked to all Clinical Practice Guidelines
- Includes Social Determinants of Health
  - Medications is one of the personal factors impacting function

(Delitto, et al, 2012)

Aging Issues
Geriatric Issues related to Pharmacology

- Increased drug use
- Altered response to drugs
- Adverse drug reaction
- Relationship between drugs and function


“Elderly patients take more drugs because they suffer more illness. Consequently, they also suffer more adverse drug reactions.”

(Sera, Et al 2012)
Medications
The Most Pressing Issue in Elder Health

- Over use of medications
- Distrust of discontinuing or drug holidays
- No one tells them to stop the medication

Medication Use & OTC

- In US, 14% of the population is over 65 but consume 33% of the prescription and OTC meds
  - By year 2030, will make up 21% of the population and take 40% of all drugs
  - This population takes average 4 prescriptions + 4 OTC daily and fills >20 different prescriptions yearly
  - Average Patient in nursing home uses 8 medications at a time
- OTC meds often not seen as Medications by the aging adult
  - Elderly purchase >40% OTC drugs
Problems to consider

- Limited studies on medications on people over age 70
  - What does it do to the body?
  - Standard adult dose is based on age 20-30yr olds (Lockett, et al 2019)
- Little regulation on herbal supplements
  - Can be as dangerous as prescription medications
  - Often not considered ‘medications’ by either patients or providers
  - May have limited information available (Wojta-Kempa et al 2016; Koronkowski et al, 2016)

Average older adult has 2-3 chronic conditions; The oldest of the elderly have over 10 different conditions

- Most conditions require medication to:
  - Control underlying pathology
  - Decrease symptoms
  - Maintain functional capacity
Special Considerations in health assessment

- Normal age-related findings must be differentiated from those indicators for disease
- Altered or nonspecific presentation of disease must be understood
- The older population under reports illness, think their complaint is just “Part of aging”
- Multiple pathological conditions may be present
- Polypharmacy (>3 medications that are either duplicate or prescribed for ADR instead of primary condition)
- Aging adults don’t recognize OTC drugs as medications

Behavior of elderly
Both genders feel they are better off than their aged cohorts

<table>
<thead>
<tr>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delay physician visits</td>
<td>Suffer from more crippling disease</td>
</tr>
<tr>
<td>Don’t freely discuss symptoms</td>
<td>When ill, will seek services more often</td>
</tr>
<tr>
<td>Suffer more from life-threatening conditions</td>
<td>More apt to use preventative services</td>
</tr>
<tr>
<td>More often have hearing loss</td>
<td>More likely to have vision problems</td>
</tr>
<tr>
<td>When ill, institutionalized more often</td>
<td>Take twice as many drugs as men</td>
</tr>
</tbody>
</table>

Adverse Drug Reactions in the Older Adult

- Considered a factor in 10-20% of hospital admissions of adults over 65
- A more common cause of hospital admission than coronary artery disease
- A major contributor to inpatient complications (Up to 35% of older inpatients will have an adverse drug reaction during a hospitalization)

(Sera 2012; CDC, 2019)

Risk Factors in Adverse Drug Reactions

- Changes in cognition
- Changes in physical function
- Side effects profiles of drugs
  - If med makes pt sick, they stop taking the med but do not tell PCP
  - If one med gives ADR, the PCP just gives another to stop that ADR
- Complexity of drug regime
  - Too many variables, bid, od, prn
  - With/without food, time of day
- Number of prescribing physicians
- Number of filling pharmacies
  - same drug but 2 different names
- Childproof caps

- Chronologic age IS NOT a risk factor
Basic Pharmacokinetics

- Absorption
- Distribution
- Metabolism
- Excretion

Physiological changes in Aging Adult

<table>
<thead>
<tr>
<th>System</th>
<th>Physiological changes</th>
<th>Pharmacokinetic impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular</td>
<td>Decreased cardiac output</td>
<td>Decreased absorption and distribution</td>
</tr>
<tr>
<td></td>
<td>Decreased blood flow</td>
<td></td>
</tr>
<tr>
<td>Gastrointestinal</td>
<td>Increase pH (resulting in alkaline gastric secretions)</td>
<td>Variability of absorption: depends on if needs to be in stomach or intestines</td>
</tr>
<tr>
<td></td>
<td>Decreased peristalsis (slower gastric emptying)</td>
<td></td>
</tr>
<tr>
<td>Hepatic</td>
<td>Decreased enzyme production</td>
<td>Decreased metabolism</td>
</tr>
<tr>
<td></td>
<td>Decrease blood flow</td>
<td></td>
</tr>
<tr>
<td>Renal</td>
<td>Decrease blood flow and glomeration rate</td>
<td>Decreased excretion</td>
</tr>
</tbody>
</table>

(Odwyer, 2016;; Sera 2012)
Age related pharmacokinetic changes

**ABSORPTION**
- Decrease gastric acidity
- Increase gastric emptying time
- Decrease intestinal blood flow

**DISTRIBUTION**
- Increase body fat
- Decrease lean body mass and total body water
- Decrease serum albumin
- Decrease cardiac output

- Fat soluble drugs may accumulate in tissues

**METABOLISM**
- Decrease liver blood flow
- Decrease liver size
- Decrease enzyme activity

**EXCRETION**
- Decrease kidney function
- Decrease blood flow to kidneys
- Decrease kidney size

- Drugs cleared by kidneys may accumulate

---

**PHARMACODYNAMICS CHANGES**

Altered sensitivity to many drugs taken at “normal level” due to:

- **Cellular Level changes:**
  - Changes in receptor types and numbers: drug-receptor binding
  - Changes in organ mass and composition: intracellular biochemistry
  - Changes in neurotransmitter production: transmembrane coupling/signaling

- **System Level changes:**
  - Orthostatic circulatory response
  - Posture/balance
  - Cognitive function
  - Muscle strength and endurance
  - Activity level
PHARMACODYNAMICS CHANGES

Decrease in sensitivity to the actions of a few drugs
Beta stimulants

Increase in sensitivity to the actions of many drugs
More sensitive to some sedative-hypnotics and analgesics

Additional factors affecting drug profile and pharmacokinetics

- Disease, co-morbidity
- Nutritional status
- Inadequate drug testing
- Patient education, compliance
- Hoarding & sharing drugs
- Financial

### Chemicals affecting drug profile

<table>
<thead>
<tr>
<th>Societal Drugs</th>
<th>Over-the-Counter Drugs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol</td>
<td>Laxatives</td>
</tr>
<tr>
<td>Nicotine</td>
<td>Analgesics</td>
</tr>
<tr>
<td>Caffeine</td>
<td>Vitamins, supplements</td>
</tr>
</tbody>
</table>

### POLYPHARMACY

**Definition:**

*Patient’s drug regime includes one or more unnecessary medications, more than just a number of drugs*

(Charlesworth, et al 2015)
FEATURES of Polypharmacy

- No apparent reason for the drug given
- Duplicate drugs, from the same class of medications
- Contraindicated drugs, causing drug-disease interaction
- Interacting drugs
- Inappropriate dose
- Use of drug is to treat an adverse reaction
- Improvement is seen when drug is discontinued

FACTORS THAT LEAD TO POLYPHARMACY

- Multiple pathologies
- Inaccurate diagnosis
- Non-specific presentation of illness
- Atypical presentation of illness
- Multiple providers
- Patient expectations: “fix me”
- Poor diet
CONSEQUENCES OF POLYPHARMACY

- Increase in adverse reactions
- Increase in the number of drug interactions
- Financial and compliance issues
- Creates a vicious cycle

Examples of Medication cascade that lead to polypharmacy

<table>
<thead>
<tr>
<th>Initial condition</th>
<th>Treatment</th>
<th>New symptom</th>
<th>Subsequent treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arthritis</td>
<td>NSAID</td>
<td>Increased BP</td>
<td>Antihypertensive drug</td>
</tr>
<tr>
<td>Depression</td>
<td>Antidepressant</td>
<td>Constipation</td>
<td>Laxative</td>
</tr>
<tr>
<td>Agitation</td>
<td>Antipsychotic</td>
<td>Stiffness</td>
<td>AntiParkinson disease drug</td>
</tr>
<tr>
<td>Hypertension</td>
<td>Diuretic</td>
<td>Incontinence</td>
<td>Antispasmodic drug</td>
</tr>
</tbody>
</table>
Identifying ADR

- Never assume a change in behavior is the result of aging
- Toxic reactions can occur at low doses
- Consider OTC meds when evaluating for ADR
- ADR symptoms can occur singularly or in clusters
- Evaluate every c/o dizziness to r/o orthostatic hypotension due to meds
- Fatigue and weakness can be caused by diuretics, antidepressants, sedatives, and antihypertensives
- Unsteady gait can be caused by anti-seizure, hypnotic sedatives, and tranquilizers

Syndromes of Adverse Drug Reactions

- Confusion and Delirium
- Dizziness, Vertigo, Orthostasis and Falls
- Anorexia and Weight Loss
- Depression
- Urinary Incontinence
- Constipation
Risks of Polypharmacy in Pain Management

- High rates of adverse drug interactions and reactions in older persons, estimated at 20%
- Variable pharmacodynamics and pharmacokinetics with aging may induce more or less sensitivity to particular drug class
- Self under-dosing (more often with pain meds)
- Opioid:
  - Drug overdose is the leading cause of accidental death in the US, with 52,404 lethal drug overdoses in 2015.
  - 20,101 overdose deaths related to prescription pain relievers, and 12,990 overdose deaths related to heroin in 2015.

Requires a comprehensive treatment approach

CDC Recommendations

- The contextual evidence review found that many nonpharmacologic therapies, including physical therapy, weight loss for knee osteoarthritis, psychological therapies such as CBT, and certain interventional procedures can ameliorate chronic pain.

- CDC 2016 Guideline for Prescribing Opioids for Chronic Pain. (updated 2019)
Falls and Medications

- Falls have continued to increase among aging adults
  - Death from falls have tripled from 2000 to 2016
  - Medication usage is cited as one of the major risk factors
    (CDC, STEADI)
- Medication review is one recommended component of a multi approach to reducing falls
  - Psychotropic meds and those taking multiple medications have greatest risk for falls
    (Avin, Et al, 2015)

Falls and Medications

- Starting a new drug seems to impact falls the most in the first 1-2 weeks of starting
- Higher doses impact falls greater
- Even though antidepressants impact falls, depression impacts falls as well
- Patients taking 4-5+ medications have increase falls
### Medications linked to falls

<table>
<thead>
<tr>
<th>Cardiovascular</th>
<th>Neurological</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antihypertensives</td>
<td>Anticholinergics</td>
</tr>
<tr>
<td>Diuretics</td>
<td>Antinauseants</td>
</tr>
<tr>
<td>Nitrates</td>
<td>Nonsteroidals</td>
</tr>
<tr>
<td>Antiarrhythmics</td>
<td>Salicylates</td>
</tr>
<tr>
<td></td>
<td>Benzodiazepines</td>
</tr>
</tbody>
</table>

### Other issues related to drugs

<table>
<thead>
<tr>
<th>Confusion</th>
<th>Anorexia</th>
<th>Incontinence</th>
<th>Constipation</th>
<th>Sleep apnea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anticholinergics</td>
<td>Digoxin</td>
<td>Diuretics</td>
<td>Opiates</td>
<td>Diuretics</td>
</tr>
<tr>
<td>Alpha Agonists</td>
<td>Antiarrhythmics</td>
<td>Alpha Blockers</td>
<td>Iron</td>
<td>Levodopa</td>
</tr>
<tr>
<td>Dopaminergic Drugs</td>
<td>Opiates</td>
<td>Anticholinergics</td>
<td>Potassium</td>
<td>Caffeine</td>
</tr>
<tr>
<td>Benzodiazepine</td>
<td>Iron</td>
<td>Alpha Agonists</td>
<td>Laxatives</td>
<td>Phenytion</td>
</tr>
<tr>
<td>H2 Blockers</td>
<td>Potassium</td>
<td>Antispasmodics</td>
<td>SSRI</td>
<td>Decongestants</td>
</tr>
<tr>
<td>Nonsteroidals</td>
<td>Laxatives</td>
<td>Muscle Relaxants</td>
<td>antidepressants</td>
<td>Beta-Blockers</td>
</tr>
<tr>
<td>Sulfa Drugs</td>
<td>SSRI</td>
<td>Calcium Channel</td>
<td>Anticholinergics</td>
<td>Bronchodilator</td>
</tr>
<tr>
<td>Beta Blockers</td>
<td>antidepressants</td>
<td>Blockers</td>
<td>H2 Blockers</td>
<td>Steroids</td>
</tr>
<tr>
<td></td>
<td>Anticholinergics</td>
<td>Sedatives</td>
<td>Proton Pump</td>
<td>Nicotine</td>
</tr>
<tr>
<td></td>
<td>Decongestants</td>
<td></td>
<td>Inhibitors</td>
<td>Alcohol</td>
</tr>
<tr>
<td></td>
<td>Amphetamines</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Delirium and Depression

<table>
<thead>
<tr>
<th>Depression</th>
<th>Delirium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beta Blockers</td>
<td>Anticholinergics: diphenhydramine</td>
</tr>
<tr>
<td>Alcohol</td>
<td>Tricyclic Antidepressants: amitriptyline, imipramine</td>
</tr>
<tr>
<td>Benzodiazepines</td>
<td>Alcohol</td>
</tr>
<tr>
<td>Alpha agonists</td>
<td>Diuretics</td>
</tr>
<tr>
<td></td>
<td>Cardiovascular drugs: digoxin, antihypertensives</td>
</tr>
<tr>
<td></td>
<td>GI drugs: cimetidine, metoclopramide, ranitidine</td>
</tr>
<tr>
<td></td>
<td>Narcotic analgesics: meperidine</td>
</tr>
<tr>
<td></td>
<td>Anti-inflammatory agents</td>
</tr>
<tr>
<td></td>
<td>Surgical Anesthesia/post operative analgesics</td>
</tr>
</tbody>
</table>

Lee, 2013

## Other causes of Delirium That Need To Be Ruled Out

- Infection
  - UTI, Pneumonia
- Metabolic Disorders
  - electrolyte imbalance, hypo/hypercalcemia
- Cardiovascular
  - MI, CHF, arrhythmia
- Neurologic
  - TIA, CVA, seizures, head trauma, CNS infections
Medication Adherence

A Definition

• Medication Adherence is the extent to which a person’s behavior taking medication corresponds with agreed recommendations of a health care provider.

(Gillard 2011)
Medication Adherence vs. Non-Compliance

- More broad based
- Includes factors from providers and the health care system
- Less paternalistic
- Views health care as a partnership between patient and provider

(Hyekyong, 2016, Reis 2016)

Medication Adherence: Some facts

- Estimated 125,000 annual deaths in the US due to medication adherence issues
- Roughly 23% of nursing facility admissions in US based in inability of patients to adhere to medication regimens
- About 10% of acute hospital admission in the US due to medication adherence issues

CDC, 2018
How many medications are taken correctly?

- The rule of three
  - 1/3 of patients take medications correctly
  - 1/3 of patients take medications incorrectly
  - 1/3 of patients don’t take medications at all

- Of 2 Billion US prescriptions written annually
  - 50% taken incorrectly
  - 15-25% never filled at pharmacy

CDC, 2018
Social and Economic Dimensions

- Availability of transportation
- Cost of medication
- Caregiver situation
- Availability and types of prescription insurance

The Health Care System

- Availability of pharmacy
- Availability of physician
- Legibility of prescription
- Accuracy of medication profiles
- Types of labeling
- Pill identification
Condition Related Factors

- Physical functioning changes
  - Ability to open containers
- Cognitive functioning changes
  - Lack of knowledge about the disease/drug
- Unpleasant side effects
  - Nausea/GI issues;
  - Fatigue
- Depression
  - Fear of dependence
- Pain issues

Therapy Related Factors

- Medication side effects
- Dosing regimens
- Size of pills
- Oral vs. parenteral dosing
Patient Related Factors

- Literacy level
- Health literacy
- Cultural norms
- Personal beliefs
- Personal behaviors and habits

Consequences:

- Under treatment
- Relapse
- Toxicity
- Increased incidence of side effects
- Unnecessary hospitalizations/ Increased medical expense

(Ritchey 2014)
Costs of medication non-adherence

- Hospital admissions
  $15.2 billion
- Nursing home admissions
  $31.5 billion
- Lost productivity
  patients and caregivers
  $78 billion

CDC, 2018

Improving Adherence in the Aging Adult

- Simplify drug regime
- Educate them on the illness and medications
- Enlist others to assist
- Reinforce patient’s responsibility
- Assess financial capacity to take medications

- Implementing Medication reconciliation and team approach
  (Curry 2005; Fraker, 2014)
OUTDATED DRUGS

Many older adults don’t understand why they have to discard medications after the expiration date.

Stability of a drug

- Defined as the time that the product will meet the specifications outlined in the drug monograph (included with each drug) and include; identity, strength, quality and purity
- Manufacturers must demonstrate that the product maintains their stability, under normal storage conditions, throughout the life of the product
- Stability is influenced by storage conditions: light, temperature, air, humidity, and packaging.
Case 1

- An elderly patient on a fixed income uses coupons at various pharmacies to have her prescription filled.

- Why is this not a good practice for this patient?

Case 2

- You are on a home health visit and the patient tells you they take all their daily medications with breakfast and all their twice a day medications at breakfast and supper.

- What would be your response?
Case 3

- During a review of medications at your home health visit with your 75 year old patient who is 1 weeks post op for a TKA, you discover expired medications. You also discover that the wife could not get out to have his morphine prescription filled due to a snowstorm, so she gave him her Celebrex since that is what she uses for her RA pain flare-ups.

- How do you handle this situation?

Beer’s List:

AGS Beers Criteria for Potentially Inappropriate Medication Use in Older Adults

Updated 2019
Specifics related to physiological systems

Musculoskeletal Common Medications for:

- Pain
- Anti inflammatory
- Muscle Spasm
- Bone Density
Analgesic

- 2 Main types of Drugs
  - Non-Narcotic
    - Cheap
    - Nonaddicting
    - Few side effects
    - Can self prescribe
  - Narcotic
    - Expensive (not really)
    - Prescription required
    - Addictive

<table>
<thead>
<tr>
<th>Non-Opioid</th>
<th>Opioid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetylsalicylic: Aspirin</td>
<td>Codeine</td>
</tr>
<tr>
<td>Acetaminophen: Tylenol</td>
<td>Hydromorphone: Dilaadid</td>
</tr>
<tr>
<td>Ibuprofen: Motrin, Advil</td>
<td>Oxycodeone: OxyCONTIN, Percocet</td>
</tr>
<tr>
<td>Naproxen: Aleve</td>
<td>Hydrocodeone: Vicodin Meperidine: Demerol F税务总局: Duragesic</td>
</tr>
</tbody>
</table>

Salicylate Drugs (aspirin)

- Most are over the counter
  - Aspirin (Bayer, Ecotrin)
  - Magnesium salicylate (Doan’s)
- These all have 3 effects
  - Pain relief-mild to moderate
  - Anti-inflammatory
  - Anti-pyretic (fever)
  - Aspirin-only one that is also anticoagulant
    - Low dose- to prevent stroke or heart attack
    - Can increase risk of stomach cancer and issues
- Not without side effects
  - Cataracts (more than 10 years)
  - Stomach issues
Nonsalicylate Drugs

- Pain relievers that don’t use aspirin
  - Acetaminophen (Tylenol)
- Two main effects:
  - Analgesic
  - Antipyretic
  - Does NOT have anti-inflammatory properties or anticoagulant effect
- Doesn’t upset the stomach
- Normal adult dosage is 1000 mg every 4-6 hours
  - Pills come from 200 mg to 1000mg (prescription level), overdose is common
- Tylenol scare in 1982-led to tamper proof containers

Patient Controlled Analgesics

- Patient activates pump to self administer small amount of opioid from a preprogrammed unit that prevents overdose
- Benefits:
  - Allows the patient control over pain with fewer side effects
  - Increases patient satisfaction
- **Requires patient awareness
Patient controlled analgesia pumps (PCA)

- Drug delivery technique
  - allows patients to self-administer small doses of the analgesics as needed to achieve adequate levels of pain control.
  - Medications are delivered more frequently and at lower doses eliminating the great plasma fluctuations.
  - The PCA is programmed to limit the amount of drugs a patient is able to self administer thus avoiding the fear of addiction developing.

(Nolan, 1995)

Questions

1. Who should activate the PCA Pump?
2. How often should the PCA pump be activate?
Nonsteroidal Anti-Inflammatory Drugs (NSAIDs)

- Analgesic effect because they reduce inflammation
- Less likely to upset stomachs or cause ulcers
- Still similar enough to aspirin that if a patient is allergic, they shouldn’t take NSAIDs
- OTC and Prescription
  - Ibuprofen (Advil and Motrin)
    - All the “profens”
      - Ketoprofen
      - Flurbiprofen
  - Naproxen (Aleve)
  - Celecoxib (Celebrex)-COX-2 Inhibitor (only one)

<table>
<thead>
<tr>
<th>Common Oral NSAIDs</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td><strong>Generic</strong></td>
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<tr>
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<tr>
<td>Ibuprofen</td>
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<tr>
<td>Ibuprofen</td>
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<tr>
<td>Celecoxib</td>
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<tr>
<td>Diclofenac</td>
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<td>Flurbiprofen</td>
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<tr>
<td>Ibuprofen</td>
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<tr>
<td>Indomethacin</td>
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<tr>
<td>Ketorolac</td>
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<tr>
<td>Meloxicam</td>
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<tr>
<td>Naproxen</td>
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<tr>
<td>Oxaprozin</td>
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<tr>
<td>Piroxicam</td>
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<tr>
<td>Sulindac</td>
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</tbody>
</table>
Non Narcotic Combo Drugs

- Anacin (aspirin and caffeine)
- Alka-Seltzer with Aspirin (aspirin and sodium bicarbonate)
- Excedrin Extra Strength (aspirin, caffeine and acetaminophen)

Narcotic Analgesics

- Moderate to severe pain
- Provide a numbing effect and a euphoric effect often leading to addiction
  - 2 that don’t: Nalbuphine and Tramadol (ultram)-non addictive
- Opioid Drugs-Schedule II Drugs
  - Morphine (Duramorph) and Codeine drugs
    - Hydromorphone (Dilaudid)
    - Fentanyl
    - Butorphanol (stadol)-comes in a nasal spray
    - Meperidine (Demerol)
    - Methadone (Methadose)
    - Oxycodone (Oxycontin)
- Opioid Epidemic
  - Over 100 tons dispensed each year
  - =roughly 60 pills for every US citizen
Common Side Effects of Narcotics

- Nausea and Vomiting
  - Take medication with food, if needed
  - Avoid fatty and spicy food
- Dizziness and Drowsiness
  - Should lessen over time
  - Get up slowly
  - Don’t drive or operate machinery
- Headache and Fatigue
  - Should lessen over time
- Constipation
  - Most common side effect, especially post surgical
  - Drink plenty of fluids/eat high fiber foods
  - Increase physical activity, walking

Non Narcotic and Narcotic Combos

- Combinations with Salicylate (Aspirin)
  - Empirin with Codeine (aspirin with codeine)
  - Percodan (apririn with codeine)
- Combinations with nonsalicylate drugs
  - Darvocet (acetaminophen and propoxyphene)
  - Lortab (acetaminophen and hydrocodone)
  - Tylemol with Codeine
  - Tylox (acetaminophen and oxycodone)
  - Vicodin (acetaminophen and hydrocodone)
- Combinations with nonsalicylate drugs and anti-inflammatory
  - Vicoprofen (ibuprofen and hydrocodone)
CASE 4

- The patient is a 60 year old male soccer player who underwent knee surgery 2 days ago. He was prescribed pain medication to be taken 2 tablets every 4 hours. By the third hour, he is in extreme pain and unable to tolerate any activity. He asks you if he can take one tablet every 2 hours.
- What do you need to ask him?
- What would you evaluate?
- Is this a need for referral?
- What is your recommendation?

Case 5

- A 65 year old female is being seen for back pain. She was given a prescription for pain medications to take 2 every 4 hours as needed for pain(prn). She has been reporting decrease in her pain and questions if she should stop taking the pain medications.
- What is your response as her therapist?
Anesthetic Drugs

Types of Anesthetics (often caine)

- Skin only - Topical
- Deep Tissue - local injection
- One body part of part of a part (Nerve Block)
- Trunk or Lower Limb (epidural or spinal block)
- These all work by blocking sodium ions in the nerve cells so they can’t send messages of pain
- Entire Body - general anesthesia
  - Sedates the CNS
Topicals

- Sprays, gels, lotion, creams
- Short periods of time
  - Minor burns
  - Cold sores
  - Eczema
  - Bug bites
- Lidocaine (Lidoderm, Xylocaine)
- Benzocaine (Dermoplast)

Local, Regional, Spinal and Epidural

- Local
  - Subcutaneous
  - Think stitches or mole removal
  - Dental surgery
- Regional—also called “a nerve block”
  - Surgery-CTS, foot
- Spinal
  - Spinal anesthesia-subarachnoid space of lumbar region
  - Epidural—into the epidural space
- Drugs used for all of these
  - Lidocaine (Xylocaine)—most widely used
  - Procine (Novocain)
    - Came from the coca bush (south American Indians would chew on it)
Epidural vs Spinal

<table>
<thead>
<tr>
<th>Epidural</th>
<th>Spinal</th>
</tr>
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<tbody>
<tr>
<td>High dose (10-20ml)</td>
<td>Low dose (1.5-2 ml)</td>
</tr>
<tr>
<td>Slow onset (25-30 min)</td>
<td>Fast onset (5 min)</td>
</tr>
<tr>
<td>No significant neuromuscular block</td>
<td>Significant neuromuscular block</td>
</tr>
<tr>
<td>Multiple doses can be done</td>
<td>Single dose only</td>
</tr>
<tr>
<td>Can be given at various spinal levels</td>
<td>Can only be given at ONE specific point to avoid spinal cord damage</td>
</tr>
</tbody>
</table>

Post spinal/Epidural risk

- Spinal cord damage
- Masks pain so may overdo
General Anesthesia

- Loss of consciousness and loss of sensation throughout the body
- Barbituates
  - Depress the CNS, in high doses unconsciousness
  - No real analgesic effect; short acting
  - Often used to get to put patient in unaware state so they can be tube
- Narcotics
  - Produce unconsciousness and block pain
    - Fentanyl
    - Meperidine (Demerol)
    - Morphine (Duramorph)
    - Oxymorphone (Opana)
    - Midazolam
    - Propofol (diprivan)—not a scheduled drug—only for anesthesia
    - Ketamine (ketalar, special K)

Inhaled Gases for General Anesthesia

- Used in conjunction with IV anesthetics
  - Nitrous oxide (laughing gas)
    - 1772—party favor
    - 1860s for medical purposes
  - Sevoflurane (Ultane)
Neuromuscular blockers-General Anesthesia

- Used to relax skeletal muscle by blocking acetylcholine
- Used to intubate patients
- Needed during many surgery (especially abdominal)
- Sucs-Succinylcholine (Quelicin)
  - May need a drug to undo it
  - Edrophonium (Reversol)

Post Anesthesia Effects

- Increased risk for delirium
- Constipation due to the impact on peristalses
- Often given a bolus of an analgesic prior to completion of surgery which increases adverse risks

- Recommendation: Early mobilization
Muscle Relaxants

- Used in the treatment of spasticity and muscle spasms
- Affects skeletal muscle function and decreases the muscle tone.
- Used to alleviate symptoms such as muscle spasm, pain, and hyperreflexia

Muscle Relaxers

- Muscle tears, sprains, soft tissue injuries
  - Often treated with the previously discussed analgesics and anti-inflammatories
  - ALSO: Drugs to relieve spasm
    - Cyclobenzaprine (Flexeril)
    - Diazepam (Valium)
    - Metaxalone (Skelaxin)
    - Methocarbamol (Robaxin)
    - Orphenadrine (Norflex)
  - These do not relieve pain or inflammation
- Severe Muscle issues (those following neurological conditions; stroke, SCI, CP)
  - Baclofen (Lioresal): oral or intrathecal
  - Diazepam (valium)
Types of Muscle Relaxants

- Neuromuscular blockers
  - Act by interfering with transmission at the neuromuscular end plate and have no central nervous system (CNS) activity
    - used during surgical procedures, in intensive care and emergency medicine to cause temporary paralysis.
- Spasmolytics
  - "centrally acting" muscle relaxants, used to:
    - Alleviate musculoskeletal pain and spasms
    - Reduce spasticity in a variety of neurological conditions.

Clinical Implications/Side effects

- Drowsiness/weakness
- Fall risk
- Too much relaxation of muscles impacting function

- With intrathecal baclofen if:
  - Nausea, vomiting, headache, CV signs
    - May indicate pump or tubing malfunction and needs immediate referral
PT/OT role with baclofen pump

- Pre assessment to assist with placement (use of Ashworth Scale for Spasticity)
- Post assessment for effectiveness
- Assess for pump function and monitor for overdose
  - Sleepiness, decrease function
- Assessment for supplemental injections or oral medications

Case 6

- You are treating a patient who was injured at work and has low back muscle spasms. He is taking Skelaxin and tells you he always wants to sleep. He is currently still working and having a problem staying awake at work.

- What is your role as a therapist?
Case 7

- A 55 year old patient with C7 tetraplegia has increased muscle spasticity in his arms and legs. The neurologist inserted the intrathecal baclofen pump. The patient’s lower extremities responded well with the decreased spasticity and he is able to stand to transfer. However, the OT states the upper extremities have too much decreased tone for the patient to be functional.

- How this can be resolved?

Osteoarthritis

- Degenerative Joint Disease (DJD)

- Drugs are used to:
  - Reduce pain
  - Reduce inflammation
  - They DO NOT reverse cartilage or bone damage
Osteoarthritis

- Acetaminophen (Tylenol) - preferred first line treatment
  - Mild to moderate pain - it does NOT decrease inflammation
  - Doesn’t upset stomach, few side effects, non addictive

- Salicylate Drugs - oldest drugs known to man
  - Aspirin (Bayer, Ecotrin) (acetylsalicylic acid or ASA) - analgesic and anti-inflammatory
  - Irritate the stomach - long term use - gastric ulcers
    - Some companies coat the aspirin (enteric-coated) to help with this

- NSAIDs - Nonsteroidal Anti-inflammatory Drugs
  - Less irritating than aspirin, but pts who can’t take aspirin may not be able to take these either
  - Primarily an Anti-inflammatory but also analgesic
  - Ibuprofen (Advil, Motrin)
  - Naproxen (Aleve, Naprosyn)
  - Meloxicam (Mobic)
  - Diclofenac (Voltaren), oral and as a topical skin gel (first one for OA)

Drugs for Osteoarthritis

- Cox-2 inhibitors - were thought to be the new best thing
  - Most were taken off market due to increase in cardiac events and stroke
  - Celecoxib (Celebrex) is the only one still on market
  - Decreases pain and inflammation without the side effects of Aspirin and NSAIDS

- Corticosteroid - only good for acute periods
  - Dexamethasone
  - Hydrocortisone
  - Prednisone
    - Can’t stop abruptly, has to taper off so the body will start producing cortisol again
RISK of corticosteroids

- Catabolic to tendons, bones
- Caution when using phonophoresis and iontophoresis with patients on long term corticosteroids

Others

- Hyaluronic Acid-injected into the joint also a dietary supplement (not a controlled med)- Glucosamine (OsteoBi-Flex)
- Topicals
  - Most are local analgesic drugs that decrease the signal of the sensory nerve
    - Aspercreme, Capsaicin, Bengay, Icy Hot
    - They have good results and pt reports
  - CAUTION with topicals:
    - Do Not use ice or heat with topicals as risk for dermatological injury
Rheumatoid Arthritis

- Autoimmune disease
- Similar treatments to OA
  - Salicylate drugs, NSAIDs, COX-2 inhibitors, Corticosteroids
- Gold Compound
  - Actual gold, many of the drugs have Au in the name
  - Can stop the attack of macrophages, cannot repair joint damage
  - Auranofin (Ridaura) or gold sodium thiomalate (Aurolate)
- Monoclonal Antibody Drugs
  - Keep lymphocytes from making antibodies to stop inflammation
  - Adalimumab (Humira)
  - Rituzimab (Rituxan)

Rheumatoid arthritis

- Immunosuppressant Drugs
  - Last resort
  - Suppresses the immune response
  - Methotrexate (Rheumatrex Dose Pack)
Osteoporosis

- Balance between:
  - Osteoblasts-builders
  - Osteoclasts-trash men
- More common in woman
  - Hormones regulate the balance
- Treated by: Blocking the Osteoclasts
- Inhibiting Bone Resorption (inhibits the osteoclasts)
  - Alendronate (Fosamax)-daily before meals
  - Ibandronate (Boniva)-daily or monthly dose
  - Zoledronic acid (Zometa)-one time per year-IV
- Estrogen Receptor Modulator Drugs-inhibits osteoclasts
  - Raloxifene (Evista)
- Estrogen Replacement
  - Conjugated estrogens (Premarian)
  - Short term use

Osteoporosis

- To stimulate new bone growth
  - Calcitonin-salmon(Miacalcin)
  - Teriparatide (Forteo)
- OTC-Calcium Supplements-More to PREVEN
  - Must be able to dissolve in vinegar within 30 minutes to be effective
  - Tums
  - Caltrate
  - OS-Cal
Clinical Implication

- Weight bearing exercises
- Core strengthening versus trunk flexion exercises
- Body mechanics training
- Some Osteoporosis drugs need to have them sit up for 30 minutes after taking
- Body can only absorb 500 mg at any one time so needs to be taken over the entire day to get the adequate amount

Neurological Conditions
Neurologic Drugs Used for:

- Brain and Nerve issues
- Epilepsy
- Dementia
- Alzheimer
- Parkinson disease
- MS
- Neuropathy and neuralgia
- Insomnia
- Drugs typically either block the neurotransmitters or replace them to alleviate symptoms

Epilepsy

- A group of neurons send impulses that spread throughout the brain
- Range from mild (staring into space) to full tonic-clonic seizures
- Drugs are called Anticonvulsants
- Different Drugs to treat
  - Phenytoin (Dilantin)-oldest and common (can reach toxic levels over time)
    - Works by affecting the flow of sodium
  - Ethosuximide (Zarontin)-depress the motor cortex- pt report groggy
  - Clonazepam (Klonopin) and Diazepam (Valium)- anticonvulsant but also impact emotion, memory, muscle tone
  - Phenobarbital (Luminal)-Barbituate-decreases nerve conduction, also a sedative
  - Topiramate(Topamax)-also used for Migraines (mini seizures:??)
    - Many off label uses
    - Alcohol and cocaine dependence
    - Bulimia but also used to assist with weight loss and cigarette cessation
Clinical Implication

- Anyone with a history of a condition impacting the brain should be asked regarding seizure history
- If a history, need to know:
  - How long they typically ask
  - What do they want the clinician to do in case of seizure
- If no history, and seizure occurs, physician must be contacted
- What do you do if a patient has a seizure during your treatment?

Vital Sings must also be taken and begin CPR if needed
Dementia and Alzheimer disease

- NOT all that forget have Alzheimer disease
- Dementia, Depression, Delerium, Drunkeness: Know the difference

Other Reasons for Dementia

- Senile dementia
- CVA’s a big one or TIA’s (mini strokes)-Multi-infarct Dementia
- Brain Trauma (slip in tub; fall):mild concussion
- Alcoholism or Drug Abuse
- MS, Parkinson
- OTHERS that mimic Dementia
  - UTI’s
  - Medication misuse
  - Stress
  - Poor nutrition/dehydration
  - Thyroid disorders
  - Vitamin B-12 deficiency
Drugs used for Alzheimer

- Cholinesterase Inhibitors
  - By inhibiting Cholinesterase, Acetylcholine is increased
  - Mild to moderate forms of Alzheimer disease
    - Can’t reverse only delay
    - Donepezil (Aricept)-can now be given at any stage
    - Tacrine (Cognex)
    - Rivastigmine (Exelon)-daily patch
- NMDA(N-methyl-D-asparat) Inhibitors
  - Moderate to severe forms
  - Memantine (Nemenda)
- Supplement to increase fatty acids
  - Caprylidene (axona)-not sure why this works

Clinical Implications

- When to start/When to stop
- Other drugs used for behavior control is not considered standard of care
- How is pain recognized in those who have dementia?
- Physical activity: aerobic exercise (walking) is now shown to help
- Decision re: when to move Out of their own home
Parkinson Disease

- Occurs because of a decrease in Dopamine which allows for too much acetylcholine to reach the receptors
  - Dopamine and acetylcholine compete for the same receptors
  - Drugs are either designed to increase Dopamine
    - Dopamine can't cross the BBB
    - So Drugs either turn to Dopamine or stimulate production of dopamine
    - Levodopa (pts call it eldopa)
    - Carbidopa (Lodosyn)
    - Rotigotine (Neupro)-patch
    - Pramipexole (Mirapex)-side effect-impulse control
    - Amantadine (Symmetrel)-also treats the flu
- Drugs that limit acetylcholine
  - Benztropine (Cogentin)
- Others for
  - Tremors-atropine
  - Parkinson's related Dementia
    - Rivastigmine (Exelon)
- Drug Holiday for Parkinson Disease

Clinical Implications

- When to start the dopamine
- Is dementia a progression of the disease or side effect of increased dopamine?
- On and off cycle: when should therapy see the patient?
- Latest research has high intensity exercise, aerobic exercise and reciprocal multi sensory exercises helps slow progression (Rock Steady, Move Big, Tango, etc)
Case 8

- A 62 year old male has recently been diagnosed with Parkinson disease. He started physical therapy last week. Today, he comes to therapy has increased rigidity and tremors. The wife states this got worse after the family reunion at the local park. Upon further investigation, you discover the patient was stung by a bee and is allergic to bees so used epinephrine like he has done for his entire life when exposed to bees.

- Why is this important to know?

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Multiple sclerosis

- Lots of different types of drugs
  - Immunosuppressant’s
  - Muscle relaxers
  - Antianxiety
  - Steroids
  - Chemo drugs
  - Botox
  - Stem cells/gene therapy
- Used to treat symptomatically
Neuropathy and Neuralgia

- Significant Number of Patients with this Dx
- Pain vs numbness or tingling (phantom pain/sensation)
- Diabetes, Shingles, Amputations, post Guillain Barre, AIDS
- Traditional Opioid Treatments don’t work for these patients
  - Antidepressants, anti anxiety, antipsychotics
    - Clonazepam (Klonopin)
  - Anticonvulsants
    - Carbamazepine (Tegretol)
    - Gabapentin (Neurontin)
    - Topicals-Lidocaine (Lidoderm)

Psyciatric Drugs
Typical Diagnosis

- Anxiety
- OCD
- Depression
- Bipolar
- Eating other disorders
- ADHD
- Alcohol and Drug addiction
- Schizophrenia

Common Drugs For Anxiety and Neurosis, Panic disorders and OCD

- Benzodiazepine
  - Alprazolam (Xanax)
  - Diazepam (Valium)
- Antidepressants
  - Work on anxiety and neurosis too
- Others
  - Meprobamate (Miltown)-addictive
  - Phenobarbital (Luminal)
  - Clonazepam (Klonopin)
- Side effects of all of these, dizziness, balance issues, foggy head, personality changes (not always good)
Drugs for Psychosis & Schizophrenia

- Linked to abnormal levels of dopamine, serotonin, acetycholine
- Antipsychotics—not typically addictive
  - Thioridazine (azine's are anti psychotics)
  - Olanzapine (apines too!) (Zyprexa)
    - Clozapine
  - Risperidone (Risperdal)
  - Aripiprazole (Abilify)
  - Haloperidol (Haldol)
  - Lurasidone (Latuda)
- These all have side effects that may require a “drug holiday”
  - Slowed movement, pill rolling, wt gain, restlessness, constipation, tardive dyskinesia, extrapyramidal effects (lip smacking, eye blinking, rocking, humming)
  - Zombie like: “I don’t feel like me”
    - High level of noncompliance
    - Right to refuse treatment

Drugs for Depression

- Non-situational Depression is due to decreased levels of the neurotransmitters: norepinephrine and serotonin in the brain
- Antidepressants—elevate the mood, increase energy levels and attention
- Historically (and sometimes for self medication) Amphetamines were used to great—addictive, masked the symptoms
- Ampitriptyline (Elavil)
- Mirtzapine (Remeron)
- Fewer Side effects
  - Escitalopram (Lexapro)
  - Fluoxetine (Prozac)
  - Sertraline (Zoloft)
  - Duloxetine (Cymbalta)
- General side effects of all: dry mouth, sexual dysfunction, abnormal dreams, nervousness, impulsivity (this is why antidepressants can place you at risk for suicide)
Bipolar-Manic Depressive Disorder

- Moods that range from anger, impulsive, manic to depressive
  - Aripiprazole (abilify)
  - Risperidone (Risperdal)
  - Clonazepam (klonopin)
  - Topiramate (Topamax)
- Can treat both phases of the disorder - mood stabilizer
  - Many patients like being manic
- Some patients need an extra boost, during the depressive state
  - Lithium
  - Fluoxetine

Compliance issues

- Many of these drugs take a few weeks to see the results so patient stop early
- Once they start feeling good, they don’t think they need the drug so stop
- Referral to social worker may be more beneficial than drugs
A 75 year old male, who has been taking anti-hypertension medication, lost his wife 5 years ago. The daughter reported to his doctor, that he has had frequent episodes of crying and withdrawal from his social activities. The doctor prescribed an antidepressant. Within 2 years, the gentleman was no longer to care for himself, often forgetting his meals, medications, and even who the family members were. He moved in with his daughter and the doctor prescribed donepezil (Aricept) for the symptoms of dementia. One afternoon, the gentleman fell downstairs and was taken to the hospital for surgical repair of a fractured femur.

He is referred to Physical Therapy with orders for touch down weight bearing. Post operative medications include: warfarin (Coumadin), chlorothizide (Diuril), hydrocodone+acetaminophen (Lortab), and lorazepam (Ativan). On day one of physical therapy, he is lethargic and not following commands. During the transfers he required maximal assist of 2 and became hypotensive. On Day two, he was combative and resistant to any movement of his operated leg. Nursing also reported, he tried to get out of bed last night.

What are the issues present?
What are case management/discharge issues present?
Anti-Psychotic Drugs for Drug Withdrawal

- Agonist-antagonist Drugs
  - First part keeps the user from having withdrawal
  - 2nd part keeps the addictive substance from working (no high)
  - Buprenorphine (Subutex)
  - Clonidine (Catapres)
    - These can be given unsupervised
    - Methadone (Dolophine) - doesn’t produce a high but can if injected so must be given in a clinic
    - Watched or given discs (can’t be dissolved)

- Smoking Cessation
  - Varenicline (Chantix) - decreased heart rate, mood issues
  - Nicotine replacement - gum, patch, spray
    - Racing heart, mouthsores, nose and throat irritation

- Alcohol
  - Disulfiram (Antabuse)
  - Nausa, headaches, dizziness

Cardiac Conditions
CARDIOVASCULAR (CV) FUNCTION AND FACTS

- Previous health factors affect CV system as we age
  - Smoking, weight gain, and exercise
- CV dysfunction with aging mimics CV dysfunction with inactivity
- Cardiovascular disease (CVD) is the most common cause of death (men 37% and women 40%)
- Of the people who died from sudden cardiac death:
  - 50% men & 63% women had NO previous symptoms
- Inadequate physical activity is responsible for 30% of deaths due to heart disease
- 10-15% of individuals following a Cardiovascular Accident (CVA) had silent ischemia
- Deep Venous Thrombosis (DVT) complications reported in 30-75% of CVA survivors

[https://www.cdc.gov/heartdisease/facts.htm](https://www.cdc.gov/heartdisease/facts.htm)

Cardiovascular

Result of disease:

The heart becomes a less efficient pump, less reserve to meet needs (especially with increased activity)

There is vascular degeneration with a thickening and loss of resilience of the arterial wall.
Myocardial Infarction

- Myocardial ischemia
  - ECG: STEMI, nonSTEMI
- Presentation:
  - Angina/pain/pressure, diaphoresis, SOB, fatigue, dizziness, nausea/vomiting

Management of STEMI Goals:

1. Increase Myocardial O2 supply
   1. Supplemental O2
   2. Ischemic pain relief (morphine)
   3. Nitrates (nitrobid, Transderm-nitro, Nitrostat)
      Thrombolytics (streptokinase, t-PA, TNKase, Retepase)
   4. Anticoagulants (heparin, LMWH, warfarin)
   5. Antiplatelet/antithrombotics (Plavix)

2. Decrease Myocardial VO2 (reduce work)
   1. Beta blockers: “lol”
   2. Calcium channel blockers: “pine”

3. Risk Factor Treatment
   1. Statins
   2. Anti hypertensive: Diuretics, beta blockers, alpha1 blockers, calcium channel blockers, ace inhibitors
Management of NSTEMI

- Also for unstable Angina
- Goals
  - Relief of ischemic pain
  - Correction of hemodynamic abnormalities
    - Antithrombotic therapy (antiplatelet/anticoagulants)
    - Surgery: Percutaneous coronary intervention (PCI) or CABG
  - Hypertension/tachycardia managed
    - Beta blockers/IV nitroglycerin
  - Evaluate and manage for risk for future events
    - Long term antiplatelets, statins, ACE inhibitors

Angina

- Any pain above the waist that occurs with an increase in exertion, that goes away with rest or nitroglycerine.
- Exertion includes exercise, emotion, extremes of temperature, eating.
- In women, can present with nausea, vomiting, fatigue, abdominal pain

- Intervention: Nitroglycerine
  - Administered orally, sublingual, or transdermal
Treatment of Angina

Usually treated with 1 of 3 groups:
1. Organic nitrates:
2. Beta blockers
3. Calcium channel blockers
Goal = restore balance between myocardial oxygen supply & demand

Treatment of Angina

1. Organic nitrates
   - Dilate vascular smooth muscle cells throughout body
   - Reduce myocardial oxygen demand
   - Also help reduce cardiac afterload
   - Side effects:
     - HA, dizziness
     - Orthostatic hypotension
Treatment of Angina

2. Beta Blockers
   - Decrease heart rate & myocardial contractions
   - May induce bronchoconstriction in respiratory conditions

3. Calcium Channel Blockers
   - Increase myocardial oxygen supply
   - Cause relaxation and vasodilation
   - Side effects:
     - HA, flushing
     - Feeling of warmth & dizziness
     - Nausea
     - Peripheral edema
Cardiomyopathy/Congestive Heart Failure

- Heart cannot contract strongly enough to empty a sufficient amount of blood for the body's needs.
- Weakened heart muscle due to
  - Hypertension (HTN), poor nutrition, toxins (alcohol/cocaine), infections, genetics, diabetes, cancer
  - This leads to dilatation of the heart chambers
    - Hypertrophied heart is stiff and does not fill easy—“floppy heart”
    - The contraction of the hypertrophied heart can obstruct blood flow

- CHF is the most common reason for hospitalization in patients >65 years

Heart Failure

- Intervention: ACE inhibitors, Beta-blockers, diuretics, HTN meds

- Exercise: used to be contraindicated; now recommendation is:
  - Moderate intensity
  - Shortness of breath (SOB) is limiting factor
  - Do not allow anaerobic exercises
  - Paced activities, short duration of exercise alternating with short rest
Common drugs for HF

- ACE Inhibitors
  - Captopril
  - Enalapril
  - Fosinopril
  - Lisinopril
- Angiotensin-Receptor Blockers
  - Candesartan
  - Losartan
  - Valsartan
- Aldosterone Receptor Antagonists
  - Spironolactone
  - Eplerenone
- Beta Blockers
  - Bisoprolol
  - Carvedilol
- Digoxin
- Anticoagulation HF+AF

Valvular Disease of the Heart

- Increases cardiac workload and reduce efficiency
- Treatment: anticoagulants
- Types:
  - Stenosis:
    - Can lead to CHF
    - Interventions include surgery
  - Insufficiency or regurgitation
Hypertension

- Increases myocardial oxygen consumption
- BP with systolic $>160$ mmHg and diastolic $>95$ mmHg leads to risk of
  - CVA, CHF, aortic aneurysm, and doubles risk of cardiovascular disease (CVD)
- BP 140/90 is cutoff to begin medical intervention, some debate about whether this should start earlier

- Medication side effects include:
  - dizziness, hypokalemia, depression, syncope, confusion, incontinence

Treatment of HTN

- Silent Killer
- Usually treated through “stepped care” approach
- WHO recommends lifestyle changes should go with medications
- Monotherapy works for most, those with severe risk factors may still use combinations.
- Several categories of Anti-HTN meds
- Categorized by their action on BP
Treatment of HTN - Diuretics

- Increase formation & excretion of urine
  - Act on kidneys to increase both water and sodium excretion
  - Also excretes extracellular fluid, sodium (leads to hyponatremia), and potassium (leads to hypokalemia)
  - Other effects: weakness, fatigue and Orthostatic hypotension
- Work well with mild-to-mod HTN
- Most common and cheapest form of treating HTN

Treatment of HTN – Beta Blockers

- Work primarily on heart muscle
- Decrease rate & force of contractions
- Result = CO ↓
- Side effects:
  - Bronchostriction if non-selective types are used
  - Orthostatic hypotension
  - Depression, fatigue, GI upset
Rehabilitation Concerns

- Mask hypoglycemia, premature fatigue, reduce time to claudication
- Decreased maximal exercise capacity
- Cannot use maximum heart rate as predictor of exercise capacity
  - Blunts HR response to exercise, best to use a stress test to get maximum heart rate
  - Must use RPE + vital signs, any increase over 20 bpm is too high
  - *remember this is a blunted response so actual rate is higher
- Increases exercise capacity in patients with angina, decreases exercise ischemia
- Orthostatic hypotension
- Of note: if medication is changed to a different beta blocker or if dose is adjusted, limit exercise to less than 20 bpm over resting even for those whose stress test showed a tolerance for higher change

Treatment of HTN – Vasodilators

- Used to decrease total peripheral resistance
- Act on smooth muscle cells of arteries and veins
- Side effects:
  - Reflex tachycardia, dizziness
  - Postural hypotension, weakness
  - Fluid retention, headaches
Rehabilitation Concerns:

- Postural hypotension
- Dizziness
- Headache
- Edema
- Fluid retention

Rehabilitation Concerns/Implications

- Orthostatic hypotension
- Better and longer exercise sessions at submaximal workload
- Caution with vasodilating effects after stopping exercise
  - BP will be Ok during exercise but will fall quickly when stops exercising
- Sublingual dose: Make sure patient has with them before beginning rehab session, check date of expiration
  (Ritchey, 2014)
Orthostatic Hypotension

- Drop of 20mmHg systolic or 10mmHg diastolic
- C/o lightheadedness when moving from supine to upright

Causes

- Hypovolemia: GI bleed, diarrhea, dehydration
- Medications:
  - Antihypertensives, anti-psychotic, anti-Parkinson

** need to be aware of this: many HTN meds lead to orthostatic hypotension, especially if combined with diuretic

Diuretics

- One of the most common prescribed
- Designed to prevent the reabsorption of sodium and potassium
- “Water Pills”-increase amounts of Uring
- Used with many different diagnosis
  - Hypertension
  - CHF with residual limb edema
  - Renal Failure
  - Cerebral Edema
Thiazide and Loop Diuretic Drugs

- Really wipes out the potassium (called potassium-wasting drugs)- Bananas are not enough
- Significant increase in urine output
- Problems:
  - Keeps anticoagulants from working
  - Decrease the effect of insulin
  - Increase the effect of some chemotherapy drugs and lithium
- Chlorothiazide (Diuril)
- Furosemide (Lasix)
- These patients are at risk for dehydration, dry mouth, falls (racing to bathroom), orthostatic hypotension, potassium and sodium depletion

Conduction System Disease

- Contractions become less effective resulting in:
  - diminished cardiac output which can lead to confusion, fatigue, poor exercise and ADL tolerance, and ultimately CHF
- Types/interventions:
  - Tachycardia: Medication treatment
  - Bradycardia: Pacemaker
  - Arrhythmia: Medication treatment
  - Ventricular dysrhythmia: Cardio defibrillator or a combination pacemaker/defibrillator
  - Atrial fibrillation: Cardio defibrillator: 15% of strokes occur in individuals with atrial fibrillation
Treatment of Cardiac Arrhythmias

Drugs are described by what they do:

Class I. Sodium channel blockers
Bind to sodium channels inhibiting the sodium influx and thereby decreasing the cardiac membrane excitability

Class II. Beta Blockers
Act by decreasing the excitatory effects of catecholamines (epinephrine/norepinephrine) on the heart slowing conduction

Class III. Drugs that prolong repolarization
Limit the ability of potassium to leave the cells; Increasing the time before another action potential is initiated, resulting in slower more stable HR/rhythm; most frequently used for Ventricular arrhythmias but also used for atrial arrhythmias

Class IV. Calcium channel blockers
Limit the entry of calcium into heart mm. Act on the SA node to decrease rate of discharge and slow conduction

Side effects:
More arrhythmias (I)
Dizziness (I, IV)
Visual disturbances, nausea (I)
Excessive bradycardia (I, II)
Heart failure (II)
Toxicity to lung, liver (III)

Rehab !!!
Monitor for change in heart rhythm or rate
Avoid sudden position changes
Other Cardiac Medications

Statins: Treatment of hyperlipidemia or high cholesterol (simvastatin/Zocor)
Most effective when used in combo with lifestyle changes
Side effects: GI upset, liver dysfunction, myopathy (!)

Hematologic Drugs
Anticoagulant drugs: Control formation of clots in venous system

Antithrombotic drugs: Control formation of clots in arterial system

Used in those with stroke, myocardial infarctions, hemophilia, deep vein thrombosis and pulmonary embolism. Can also be administered following surgery

Anticoagulants & Antithrombotics
Rehab !!!

Be aware of patients with open wounds
Be careful of any exercise or modality that could cause tissue trauma
Gastric irritation
Symptoms such as back pain, HA may indicate internal bleeding
Anticoagulants

- Goal: prevent blood Clots
  - Thin the blood
  - Prevent clotting by impacting the clotting factor
  - Given after myocardial infarction, prevent DVT
- Heparin Drugs
  - Clotting factor X
  - IV Or Injection-usually in the Hospital, go to orals when sent home
  - Heparin
  - Heparin Lock- or saline (more now)

- Warfarin (Coumadin)
  - Clotting factors II, VII, and X
  - Oral or injection
  - Potential Food Interaction-Vitamin K- broccoli, soy, other green leafy veggies
  - Should be taken the same time each day
- Antiplatelet Drugs
  - Aspirin (Bayer)
  - Clopidogrel (Plavix)
- Factor Xa Inhibiting Drugs
  - Given to many joint replacement (other surgeries too)
    - Apixaban (Eliquis)
    - Prevents PE, CVA, DVT
Major Side effects

- Excessive bleeding: increased time to clot
  - Passing blood in urine
  - Excessive bruising
  - Frequent excessive nose bleeds
  - Bleeding gums
  - Vomiting or coughing up blood
  - Difficulty breathing
  - Sudden back pain
  - Females: increase vaginal bleeding

Other signs to be aware

- Diarrhea or constipation
- Indigestion or feeling of being sick
- Dizziness, headache, disorientation
- Rash, itchy skin, hair loss, jaundice
- Muscle weakness, decreased motor skills
Antithrombotics

- Clot Busters
- Indications:
  - Myocardial infarction
  - Ischemic stroke
- Mechanism of action:
  - Inhibit platelet activity by decreasing platelet-inducing clots
- Types:
  - Aspirin
    - Inhibits prostaglandin (PG) by inhibiting the key enzyme COX
    - Inhibits thromboxane (TX)
      - decreases platelet activity/aggregation
      - ultimately less platelet-induced clots
  - Inhibits platelet function which prevents arterial thrombogenesis
  - *Therapeutic effects of aspirin occur at extremely low doses

Anti Thrombolytics

- Actions:
  - Initiate clot breakdown by activating plasmin (fibrinolysin)
  - Helps dissolve clots in coronary, carotid arteries
  - Can restore blood flow; prevent/reverse damage during MI, ischemic stroke
- Types:
  - Streptokinase (Streptase, Kabbikinase)
  - Recombinant tissue plasminogen activator: tPA: alteplase (Activase)
  - Anisoylated plasminogen streptokinase activator complex: APSAC:
    - anistreplace (Eminase)
  - Newer “bolus dose” agents:
    - reteplase: rPA (Retavase)
    - tenecteplace: TNK-tPA, TNKase
Use in MI

- Can decrease mortality by 50%
- Quick, early administration increases survival and improves outcomes
- 3-6 hours after symptom onset, can still be effective up to 12 hrs
- ****No agent superior to other---not which drug but how fast administered!

Use in ischemic stroke

- First rule out hemorrhagic stroke
- Alteplase (r-tPA) seems superior to streptokinase
- Administer within 3 hours after symptom onset, but has been shown to be effective even if given later
- Many times, definite diagnosis of ischemic stroke has not been made this quickly so must balance risks of delay administration with that of hemorrhagic stroke
Anticlotting drugs Rehabilitation concerns

- Hypotension
- Risk of hemorrhage:
  - Wound care issues
  - Aggressive manual therapy
  - Teaching safe brushing of teeth

Headaches, rash, allergic reactions can also occur

Clotting deficiencies

- Hemophilia
  - Clotting factor replacement:
    - Factor VIII (type A)
    - Factor IX (type B)
  - Fibrinolysis inhibitors (aminocaproic acid, tranexamic acid)
  - Vitamin K supplements

- Rehabilitation concern:
  - Risk for internal bleeding with manual therapy
  - Always be aware of bleeding issues
Case 10

- During the evaluation the patient denies any heart problems but you notice a cardiac medication on his medication list
- How would you handle this situation?

Case 11

- A 68 year old patient has been seen by Physical Therapy for general strengthening for 2 weeks without any incident of angina. Today you find out he forgot to refill his nitroglycerin tablets.

- What is your response and how would you handle today’s therapy session?
PULMONARY SYSTEM: Common diagnoses and medical management

Restrictive vs Obstructive Disease

- **Restrictive**
  - Can’t get air in
  - Oxygen is beneficial
  - Pulmonary Fibrosis, some pneumonias, asthma

- **Obstructive**
  - Can’t get air out
  - Giving more oxygen may be harmful

ALWAYS check with physician re: whether increasing the oxygen will be beneficial to the patient: **KNOW** parameters
Pneumonia

- Increased incidence with aging
  - Inactive adults: core temperature is lower
- 1 Million hospital admissions, 140,000 readmissions
- Typical symptoms
  - Cough, fever, pleural pain (subtle in elderly, need to use a stethoscope)
- Other symptoms
  - Confusion, alterations of sleep-wake cycle, increased CHF, anorexia

Pneumonia

- Types:
  - Infectious: viral, bacterial, aspiration
  - Noninfectious: neoplastic, inflammatory, drug induced
- Restrictive not obstructive
  - Decreased force capacity
- Nosocomial vs community acquired
- Complications:
  - Emphysema/lung abscess
  - Pleural effusions
ASTHMA

- 15 million people in US have some form of asthma
- Spasm, narrowing of airways due to inflammation
- Triggered by allergens, exercise, tobacco smoke, cold air, infections, NSAIDS, GERD, sinusitis
- Symptoms
  - SOB, coughing, wheezing
  - “like a fish out of water”

Pharmaceuticals for Asthma

- Goal: Decrease or eliminate chronic inflammation and treat flare-ups
- Quick Release Medications
  - Bronchodilators
    - Beta 2 agonists, anticholinergics, corticosteroids
- Long Term control Medications
  - Inhaled corticosteroids
  - Long acting Beta agonists
  - Leukotriene Modifiers
  - Methylxanthines
Pharmaceutical Management

- Traditional method:
  - Mild-moderate stages: inhaled beta-2 agonist, oral theophylline
  - More severe stages: add oral glucocorticoid

- Recent strategy:
  - Begin inhaled glucocorticoid fairly early and add other drugs as needed

Rehab issues

- Quick relief and long term issues with corticosteroids
- Skipping doses because they feel better
- Technique for use of inhaler:
  - Spacer needs? Bending over to use? Rinsing after use?
- Frequent dosing during therapy/sports
- Can PT/OT use the Peak Flow Meter/make recommendations? Do you know the volumes that require attention?
- Effect of warm up before therapy?
Chronic Obstructive Pulmonary Disease (COPD)

- Chronic inflammatory response in airways and lungs to noxious particles or gases; often coexisting with other dx
- Hypoxia, dyspnea, confusion, fatigue
- 4th leading cause of death
- Emphysema
  - Permanent destruction (enlargement) of alveoli (pink puffers)—distal to terminal bronchioles
- Chronic Bronchitis:
  - Inflammation of small airways (blue bloaters)
  - Chronic productive cough x 3 months in 2 consecutive yrs.
Chronic Bronchitis

- Expectoration on most days for at least 3 months/yr for at least 2 years
- Hypertrophy of mucous glands and bronchial smooth muscles
- Small airway inflammation

Emphysema

- Enlargement of air spaces
- α1-antitrypsin deficiency

COPD Medications

- Beta-agonists
  - Short acting (fenoterol, albuterol)
  - Long acting (formoterol, salmeterol, tulobuterol)
- Anticholinergics
  - Short acting (ipratropium bromide)
- Combination short acting beta-agonists plus anticholinergic
  - Fenoterol/ipratropium
  - Salbuterol/ipratropium
- Methylxanthines
  - Aminophylline, theophylline
- Inhaled corticosteroids
  - Beclamethasone, fluticasone
- Systemic corticosteroids
  - Prednisone
  - Methyl-prednisolone

ADVERSE EFFECTS:
Catabolic to soft tissue
### Pulmonary Medications

<table>
<thead>
<tr>
<th>Drug/type</th>
<th>Use</th>
<th>Adverse Effects</th>
<th>Rehab implication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antitussives: opioids, non opioids, antihistamines</td>
<td>Block Hz receptors suppress cough, local anesthetic</td>
<td>Sedation, dizziness, GI upset</td>
<td>Overuse, dependence, limits cough production so build up of fluid in lungs increasing pneumonia risk</td>
</tr>
<tr>
<td>Decongestants: epinephrine, pseudoephedrine (Sudafed, Afrin, Vicks Vapo)</td>
<td>Vasoconstriction of nasal mucus</td>
<td>Headache, nausea, nervousness, CV stimulation</td>
<td>Dependence, overuse, cardiac palpitations, increased resting BP</td>
</tr>
<tr>
<td>Mucolytics/expectorants</td>
<td>Liquify mucus for ease of ejecting the phlegm; increase effectiveness of postural drainage</td>
<td>Nausea, vomiting, kidney stones and constipation, mild dry mouth and chapped lips</td>
<td>Increases the effects of angesics, muscle relaxers, sedatives; encourage water intake when using these to avoid dehydration</td>
</tr>
<tr>
<td>Antihistamines: Benadryl, allegra, dramomine, Clariton</td>
<td>Allergies, sinus infections, motion sickness, poison ivy</td>
<td>Sedation, fatigue, incoordination, blurred vision</td>
<td>Sedative; decrease productive cough; dehydration: decreased sweating, urinary retention, dry mouth, blurred vision, tachycardia, constipation, photosensitivity</td>
</tr>
</tbody>
</table>

### Bronchodilators

<table>
<thead>
<tr>
<th>Drug/type</th>
<th>Use</th>
<th>Adverse Effects</th>
<th>Rehab implication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beta-adrenergic agonists: Albuterol, terbutaline, epinephrine, ephedrine</td>
<td>Initiates smooth muscle relaxation-bronchodilation</td>
<td>Bronchial irritation/constriction with excessive use, cardiac stimulation</td>
<td>Onset in 5 min, lasts 2-6 hrs, tachycardia, mm tremors; **best if used 15-30 min prior to PT</td>
</tr>
<tr>
<td>Anticholinergics; Ipratropium (lung specific is tiotropium)</td>
<td>Relaxes smooth muscle by inhibiting ACH receptors</td>
<td>Anticholinergic package: dry mouth, constipation, tachycardia, confusion</td>
<td></td>
</tr>
</tbody>
</table>

Timing of therapy in relation to use, watch for overuse, better to utilize a distributed practice session for intermittent rests.
Smoking Cessation drugs

- Why do we care?
  - OT and PT-required reporter
  - Impact to care
- Nicotine is highly addictive
  - Alertness
  - Pleasure
- Nicotine Drugs
  - OTC or prescriptions
  - Patches, gum, nasal sprays, lozenges
  - nicoDerm
  - Nicorette
    - still get the nicotine (still addicted)
- Nicotine Antagonist
  - Blocks the nicotine receptors
  - No joy
  - Varencliline (Chantix)
- Antidepressants

- Side effects of Nicotine replacement
  - Increased BP and HR
  - Nervousness
  - Mouth sores
  - Hiccups
  - Loss of weight or appetite

Case 12

- A patient has been seen by you for treatment of knee pain. He cancelled his last treatment due to having a cold. Today he is extremely sleepy, c/o dizziness and nausea.
- What are some causative factors?
Case 13

- A patient with pulmonary fibrosis is on 3 liters of constant O2 and you are seeing him for Home Health therapy. His wife reports that in the morning during the basic grooming tasks he gets so short of breath that she has been increasing the oxygen to 5 liters until he is done then turns this back to the 3 liters.
- How do you respond?
- Would this be different if his diagnosis was emphysema/COPD?

Urinary and Gastro Drugs
Urinary Tract Infections (UTI)

- Common in immobile patients
- Behavioral, memory and personality changes
- Drugs Treat:
  - Infection
    - Nalidixic acid (NegGram)
    - Trimethoprim (Proloprim)
    - Acetohydroxamic acid (Lithostat)
  - Analgesic (doesn’t impact infection)
    - Phenazopyridine (Pyridium-EZO)-turns urine orange
  - Role of Cranberry Juice

Overactive Bladder

- Finally!!
- These drugs are heavily advertised, 65% increase in their use in recent years
- Tolerodine (Detrol)
- Darifenacin (Enablex)

- Side effect of these is blurred vision with corresponding dizziness!
Erectile Dysfunction Drugs

- Oral and Prescriptions
- Sildenafil (Viagra)
- Tadalafil (Cialis)
- Side Effects:
  - Other than those advertised!
  - Loss of blue/green color temporarily
  - Nasal congestion, hearing and vision loss
  - Hypotension
- **those with cardiac conditions need to discuss with physician before taking ED drugs

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Gastro intestinal Issues
GI Physiology quick review

- Stomach is highly acidic
- Gastric acid (hydrochloric acid-HCL), gastrin, acetylcholine and histamine released when food present
- Parietal cells in stomach have receptors for histamine, ACH, and gastrin and when stimulated proton pump is activated
- PP transports hydrogen ions to the stomach to combine with chloride to form HCL
- Overall role of stomach acid is to convert pepsinogen to pepsin (for digestion)

Cont...

- Prostaglandins help to inhibit excessive acid production by inhibiting acid secretion (PGE2) and increase secretion of protective mucos and bicarbonate buffer from epithelial cells (PGI2)
- Duodenum
  - is where digestion and absorption occurs and can be damage if intestinal mucosa is damaged from gastric acids
  - Mucus protects and lubricates the intestines
  - Bacteria are present here to breakdown waste and produce vitamins
  - Diarrhea can result form imbalance of the bacteria or yeast normally present
Peristalsis

- Movement through intestines
  - Too fast: diarrhea
  - Too slow: constipation
  - Slowed during surgery through pharmaceuticals

- Rate of movement/mucus secretion control
  - Parasympathetic
    - Increases rate of peristalsis and mucus secretion
  - Sympathetic
    - Decreases rate and secretion

  "Cholinergic drugs increase movement through intestines"

Treatment interventions

- Antacids
  - This decreases the acid content of the stomach
  - Since these are easily obtained over the counter, many people don’t inform their physician about taking them for mild symptoms. This can delay proper evaluation and interfere with medications taken for other diagnosis.

- Diet
  - Changes in diet to avoid spicy foods and avoid overeating. This has been the traditional recommendation, but recent research by GI physicians has challenged this practice.

- Endoscopy
  - Performed in patients over the age 55, those with symptoms suggestive of cancer, and those with persistent symptoms

- Surgery: performed on those with:
  - Bleeding
  - Peritonitis
  - Surgical complications:
    - Perforation, gastric outlet obstruction
Proton Pump Inhibitor (probiotics)

- Associated with 80-100% healing if given 4 weeks for duodenal ulcer and 8 weeks for gastric ulcer. Currently, most insurance companies do not pay for prescription medications until over the counter medications have been tried and failed.
- Decreases pH by decreasing H⁺, K⁺ ATPase inhibiting acetylcholine, gastrin and histamine.
- Types:
  - omeprazole (Prilosec)
  - lansoprazole (Prevacid)
  - rabeprazole (Aciphex)
  - pantoprazole (Protonix)
  - sucralfate (Carafate)
  - esomeprazole (Nexium)

Antacids

- Neutralize gastric acid increasing pH
  - Maalox, Mylanta, Tums, Rolaids

- Interferes with absorption of other drugs: antibiotics and NSAIDS.
Gastroesophageal reflux disease (GERD)

- Seen more often in elderly and treated similar to ulcers.
- Caused by increase intraabdominal pressure (lifting, straining, etc), obesity, overeating, hiatal hernia, pregnancy
- Recommendation is usually, not to eat right before they lay down.
- A patient with GERD would not be able to tolerate supine exercises that would put pressure on the abdomen such as SLR, curl ups etc. as these would cause the acid reflux.

Case 14

- A patient who has had a THA also has a comorbidity of GERD.
- What are the implications of the medications for both conditions on the postoperative care in therapy?
Diabetes mellitus is a costly, chronic disease that affects millions of people each year. Diabetes is an increasing concern with the poor lifestyles of the American population. The diet and lack of exercise has increased the number of people with diabetes and those at risk of developing diabetes.

- The classic triad of diabetes management include, diet, exercise and pharmaceutical interventions.
- People with Diabetes Mellitus (DM) are more prone to silent ischemia, postural hypotension, and/or blunted heart rate response, all of which affects PT interventions.
Diagnosis:

- Normal < 100 mg/dl
- Impaired Fasting plasma glucose 100-125 mg/dl
- Impaired glucose tolerance (2 hr) 140-199 mg/dl
- Diabetes, fasting > 126 mg/dl

Exercise increases absorption of glucose into insulin sensitive tissues by:
- Increasing blood flow thus enhancing glucose and insulin delivery into blood stream
- Stimulation of glucose distribution by muscle contraction

Effects of Insulin:

- Increases:
  - Glucose entry, storage in tissues (esp. muscles and liver)
  - Protein synthesis
  - Lipid storage
- Insulin Insufficiency leads to:
  - Acute Problems
    - Hyperglycemia followed by hypoglycemia
    - Shift to fat metabolism... ketones (smells like alcohol on breath)
  - Chronic Problems
    - Repeated/prolonged hyperglycemia
    - Small vessel angiopathy, occlusion
- Side effects:
  - Rash
  - Lipohypertrophy
  - Cough—only with inhaled insulin
Insulin Therapy includes

- Monitoring blood glucose and adjust dosage accordingly
- Explain benefits of tight control of insulin levels
- Utilization of insulin pumps
- Insulin Therapy adverse effects:
  - Immunologic reaction
  - Hypoglycemia: as a result of:
    - Dose is too high
    - Delayed/missed meal
    - Strenuous exercise
- Patients should inject insulin in sites away from exercising muscles
- Each form of insulin has a different timing of onset, peak, and duration of action
- At Peak Insulin time:
  - Hypoglycemia with exercise is more likely
  - Extra blood glucose checks may be necessary to avoid hypoglycemia
  - Extra carbohydrates may need to be ingested
### Table of Insulin Products

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Product</th>
<th>Onset</th>
<th>Peak Action</th>
<th>Duration of Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rapid-acting</td>
<td>Lispro Aspart Giulisine</td>
<td>10-30 min</td>
<td>30 min-3 hours</td>
<td>3-5 hours</td>
</tr>
<tr>
<td>Short-acting</td>
<td>Regular(R) Human</td>
<td>30-60 min</td>
<td>2-5 hours</td>
<td>Up to 12 hours</td>
</tr>
<tr>
<td>Intermediate-acting</td>
<td>NPH (N) Human</td>
<td>90 min-4 hours</td>
<td>4-12 hours</td>
<td>Up to 24 hours</td>
</tr>
<tr>
<td>Long-acting</td>
<td>Glargine Detemir</td>
<td>45 min-4 hours</td>
<td>Minimal</td>
<td>Up to 24 hours</td>
</tr>
</tbody>
</table>

(https://www.joslin.org/managing_your_diabetes_3630.asp)

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### Rehabilitation Concerns

- Absorption affected by:
  - Physical agents (heat and cold)
  - Massage
  - Exercise

- Take insulin 60-90 minutes before exercise to minimize the exercise induced absorption of insulin

- Location of injection sites can lead to scar tissue development
Oral antidiabetic agents

- Various types of medical interventions and can combine oral antidiabetics
- Insulin can be added if needed
- Primary problem is hypoglycemia
- Side effects:
  - Gastrointestinal: Anorexia, flatulence, indigestion, heartburn, nausea, vomiting, diarrhea
  - Asthenia
  - Metallic taste
- *Most should be taken 30 minutes prior to or with meals.

Treatment: EXERCISE

- Glucose levels may swing dramatically during exercise:
  - carefully monitor levels
- Exercise with caution when
  - glucose levels are >300 mg/dl, if without ketosis, and the person is feeling well and is well hydrated
- Exercise at the same time every day
  - Monitor glucose pre and post exercise
    - if < 100 if treated with insulin or insulin secretagogues, ingest carbohydrates (15gm) pre exercise
    - if >250, delay exercise until levels drop
  - Maintain hydration before, during and after
Special Considerations

- Wear correct footwear
- Carry fast-acting carbohydrates
- Do not exercise during peak insulin action
- Rotate injection sites (prefer w/in abdominal region) and avoid area of active muscles
- Hydrate before, during, and after exercise

Exercise: Considerations

- Reduced capacity to dissipate heat during and after 60 min of continuous
- Exercise over 80% of Karvonen (considered vigorous) may lead to hyperglycemia after the exercise
- If patient has retinopathy, avoid jarring the head and Vasalva during exercise
CASE 15

- A patient you are evaluating in home health reports their morning blood glucose reading was 485. They say they are fine and have no signs of confusion.
- What is your response?

Cancer
General Side Effects

- Depends on type of medication but includes:
  - fatigue, anorexia, nausea, osteoporosis
  - Headache, renal toxicity, respiratory distress, ulceration, pain
  - photosensitivity, blisters on palm/soles, cardiac arrhythmias
  - GI disturbance, urinary retention, BP fluxuation, Weight loss, dyspnea, allergic reactions

Rehabilitation Recommendations

- An exercise program to: improve endurance in order to perform ADL, hand therapy for fine motor skills
- Weight bearing activities to: Prevent the secondary complication of osteoporosis
- Balance/gait training; Mobility aids evaluation
- Breathing and coughing exercises
- Self monitoring of cardiac status; monitor vital signs
- Sensory stimulation for dyesthesias
Overall Recommendations

- Acknowledge severe toxic effects;
  - Fatigue, neurotoxicity, GI problems, skin rashes, hair loss, anemia
- Monitor for signs of infection and bruising
- Edema and pain management
- Patient support, reassurance
- Relaxation therapy
- Interventions to maintain independence
  - ADL, mobility aids, assistive devices

Case 16

- You are treating a patient for shoulder pain and she is currently receiving chemotherapy post mastectomy.

- What are some of the considerations regarding treating this patient?
Summary based on FSBPT agreement for PT in HH

1. Review and assessment of patient’s medication regime.
   - Review a patient's medication and may do a functional assessment re: ability to retrieve medication bottles, open the bottles, proper following of prescription
   - PTs cannot determine what drugs are appropriate nor suggest specific dosages or changes in drug therapy to patients.
   - Educate patient regarding the medication prescription, including precautions with regards to physical activity, timing of medications, with/without food as per prescribing instructions

2. Monitoring the patient’s response to certain medications.
   - Recognize the side effects of medications and respond to crisis situations
   - Document in medical notes:
     - Medication list
     - Response to medication and impact on POC and progress
   - Complete the medication intake form

3. Reporting patient’s response to medication
   - Contact nursing and/or physician if side effects are observed and/or activate EMS if needed
   - Refer to social worker or other health professional if adherence issues related to SDOH is noticed
References

- See Reference list provided