A Pharmacy Primer for Speech-Language Pathologists and Audiologists

“misery acquaints a man with strange bed-fellows”
The Tempest
Act 2, Scene 2

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Disclosure

• I have no relevant financial or nonfinancial relationship(s) within the products or services described, reviewed, evaluated or compared in this presentation.
BASED ON YOUR PRACTICE SITE:
(OR WHATEVER YOU MAY BE CURIOUS ABOUT)

- Jot down
- Questions
- Clinical dilemmas
- Case scenarios
Objectives

Pharmacy
- Understand “behind the scenes” of pharmacy
- Understand basic principles of pharmacology

Pharmacodynamics
- Define adverse drug reaction
- Identify medications with negative side effects on hearing, swallowing, speech and cognition

Applying to Patient Care
- Use medication knowledge to positively impact a patient’s therapeutic plan
Who are You?

• Work with all age groups
  • Neonates – Geriatrics

• Work in multiple practice settings
  • Schools
  • Inpatient, Outpatient, Rehabilitation facilities, Skilled Nursing Facilities
  • Private Practice
**Broad Spectrum of Potential Diagnosis**

- **Speech/Language**
  - Speech/language delays and disorders
  - Language fluency
  - Cognition and communication disorders
  - Pre-literacy and literacy skills
  - Dysphagia/swallowing disorders

- **Hearing**
  - Hearing loss
  - Dizziness and Balance
  - Tinnitus
  - Noise and Hearing loss prevention
  - Hearing screening and testing
Medication Guide

Celexa® (se-lek-sa)
citalopram hydrobromide)
Tablets

Read the Medication Guide that comes with Celexa before you start taking it and each time you get a refill. There may be new information. This Medication Guide does not take the place of talking to your healthcare provider about your medical condition or treatment. Talk with your healthcare provider if there is something you do not understand or want to learn more about.

What is the most important information I should know about Celexa?

Celexa and other antidepressant medicines may cause serious side effects, including:

1. Suicidal thoughts or actions:
   - Celexa and other antidepressant medicines may increase suicidal thoughts or actions in some children, teenagers, or young adults within the first few months of treatment or when the dose is changed.
   - Depression or other serious mental health problems may get worse when you start taking Celexa, or when you dose is changed. Call your doctor if you have suicidal thoughts.

   Following symptoms, or call 911 if an emergency, especially if they are new, worse, or worry you:
   - attempts to commit suicide
   - acting on dangerous impulses
   - acting aggressive or violent
   - thoughts about suicide or dying
   - new or worse depression
   - new or worse anxiety or panic attacks
   - feeling agitated, restless, angry or irritable
   - trouble sleeping
   - an increase in activity or talking more than what is normal for you

2. Other serious side effects may include:
   - extreme changes in behavior such as acting on dangerous impulses, acting aggressive or violent, impulsiveness or9
Pharmacology: Study of drugs and interactions with living organisms

Pharmacotherapeutics: Use of drugs to prevent, diagnosis and treat diseases

Pharmacodynamics: The biochemical and physical effects of drugs and MOA (mechanism of action)
What does the drug do to the body?

Pharmacokinetics: How drugs move through body
What does the body do to the drug?
- Absorption
- Distribution
- Metabolism
- Excretion
PHARMACO.....WHAT???

- **Pharmacogenetics:** How genetic makeup of different people, ethnicities, gender affects response to certain drugs

- **Pharmacogenomics:** Study of how genes affect a person’s response to drugs
Chemical Formula: C13-H18-O2
Chemical Name: α-p-isobutylphenylpropionic acid
Generic: Ibuprofen
Brand Name: Advil®, Motrin®, Nurofen®
Chemical Name
sodium [(9S,13S,14S)-13-methyl-17-oxo-9,11,12,14,15,16-hexahydro-6H-cyclopenta[a]phenanthren-3-yl] sulfate

Source: Pregnant Mare’s Urine

Generic Name: Conjugated Estrogens

Brand Name: Premarin
WHERE DO DRUGS COME FROM

► Plants
  ► Alkaloids – most active component of plants (atropine, caffeine, nicotine)
  ► Glycosides – active component (digoxin)
  ► Gums – interact and hold water
  ► Resins - pine tree sap – irritant, laxative
  ► Oils – volatile – peppermint, spearmint, juniper or fixed – castor oil, olive oil

► Minerals
► Animals
► Laboratories
### Plant Sources

<table>
<thead>
<tr>
<th>Plant Sources</th>
<th>Modern Drug</th>
</tr>
</thead>
<tbody>
<tr>
<td>black cohosh</td>
<td>Remifemin (used to treat menopause hot flashes)</td>
</tr>
<tr>
<td>cinchona bark</td>
<td>quinine (used to treat malaria)</td>
</tr>
<tr>
<td>cocoa butter</td>
<td>binder or filler ingredient</td>
</tr>
<tr>
<td>hot pepper plant mold</td>
<td>capsaicin (topical pain relief)</td>
</tr>
<tr>
<td>periwinkle (vinca)</td>
<td>penicillin (antibiotic drug)</td>
</tr>
<tr>
<td>rose hips</td>
<td>statin drugs (used to treat high cholesterol)</td>
</tr>
<tr>
<td>snakeroot</td>
<td>vincristine (used to treat cancer)</td>
</tr>
<tr>
<td>willow bark</td>
<td>vitamin C (see <strong>FIGURE 1-5</strong>)</td>
</tr>
<tr>
<td></td>
<td>reserpine (used to treat hypertension)</td>
</tr>
<tr>
<td></td>
<td>aspirin (used to treat pain)</td>
</tr>
</tbody>
</table>

### Opium Poppy
- Morphine
- Heroin

### Colchicum autumnale
- Colchicine
- Gout

### Daffodils
- Galantamine
- Alzheimer's

### Black Cohosh
- Hot flashes

### Rose Hips
- Vitamin C

**FIGURE 1-5** Rose hips.
Hips are the botanical name for the rounded fruit of a rose. Powdered rose hips are still the source of natural vitamin C in some over-the-counter vitamin C dietary supplements. Other products use synthetic vitamin C.
Pregnant Mare Urine
Premarin
Hormone Replacement

Brazilian Arrowhead Viper
Captopril
Hypertension

Coho Salmon
Calcitonin, Miacalcin
Osteoporosis

Gila Monster Spit
Byetta
Diabetes

Sheep
Lanolin

Beef and Pork
Insulin
Diabetes

Pork
Dessicated thyroid
Heparin
HOW DRUGS COME....
HOW DRUGS COME....

- **Oral**
  - Tablets, capsules, orally dispersible tablets
  - Sublingual sprays, tablets, liquids
  - Solutions, syrups, suspensions

- **Topical**
  - Suspensions
  - Sprays
  - Creams, ointments
  - Patches
  - Orally or nasally inhaled powders and aerosols
  - Suppositories

- **Intramuscular**
- **Intravenous**
- **Subcutaneous**
  - Liquids
  - Suspensions
  - Emulsions
  - Powder for reconstitution

- **Immediate vs Sustained release**
Drugs to Not Crush or Chew

Do not crush any oral medication that is labeled as:

- Delayed Release
- Enteric-coated (EC)
- Extended release
- Effervescent tablet (EVT)
- Mucous Membrane irritant (MMI)
- Orally Disintegrating tablets (ODT)
- Slow-release (SR)
- Sublingual forms of drugs
- Sustained-release
Guide for Crushing Oral Medication for Residents with Swallowing Difficulties in Residential Aged Care

<table>
<thead>
<tr>
<th>Medicine</th>
<th>Funded brand</th>
<th>Form</th>
<th>Administration if swallowing difficulties</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACICLOVIR</td>
<td>Lovir</td>
<td>Tablet</td>
<td>Soluble, dispersible(^4) Swallow whole or disperse in at least 50mL of water(^3)</td>
</tr>
<tr>
<td>ALENDRONATE, ALENDRONATE with</td>
<td>Fosamax</td>
<td>Tablet</td>
<td>Do not divide, crush, chew or disperse(^3,4) Mucous membrane irritant(^1,4) Alternate bisphosphonate available as injection(^3)</td>
</tr>
<tr>
<td>COLECALCIFEROL</td>
<td>Fosamax Plus</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
“This drug was tested on 2000 white mice, and they had a ball.”

David W. Harbaugh.
PROCESS FOR CLINICAL TRIALS

- Preclinical Testing. (3 ½ years)
  - 5 of 5000 progress to human testing
- IND
  - Investigational New Drug Application
- Phase I Clinical Trial (1 year)
  - Healthy volunteers
- Phase II (2 years)
  - 50 to 500 of people with disease
- Phase III (3 years)
  - Several hundred – thousands people

EARN $400

Healthy male/female volunteers age 18 to 35 needed now to participate in upcoming inpatient studies. Stay in our pleasant dormitory at Utopia University, with recreational facilities available.

CENTER FOR VACCINE DEVELOPMENT
Utopia University
PROCESS FOR CLINICAL TRIALS

• New Drug Applications to FDA – Review of Results (2 ½ years)
  
  • FY 2017: 157 submitted, 114 approved
  
  • 1 in 5 will make it to the market

• Phase IV: Clinical testing
  
  • Post Marketing Surveillance
  
  • Adverse Drug Reaction Reporting
    - MEDWATCH
PHARMACOKINETICS –
What the body does to the drug

(1) Drug administration
- Oral, intravenous, intraperitoneal, subcutaneous, intramuscular, inhalation

(2) Absorption and distribution
- Membranes of oral cavity, gastrointestinal tract, peritoneum, skin, muscles, lungs

(3) Binding
- Target site: Neuron receptor
- Inactive storage depots: Bone and fat
- Blood plasma
- Metabolites

(4) Inactivation
- Liver

(5) Excretion
- Intestines, kidneys, lungs, sweat glands, etc.
- Excretion products: Feces, urine, water vapor, sweat, saliva
PHARMACOKINETICS

Absorption

Distribution

Metabolism

Excretion
ABSORPTION
FACTORS AFFECTING DRUG ABSORPTION

- Drugs absorbed through the skin
  - Thickness of skin
  - Open wounds
  - Age

- Drugs absorbed in the GI Tract
  - Vomiting
  - Diarrhea
  - Ostomy
  - Surgical removal of intestines

Table 2.1: Factors That Affect Absorption of Drugs

<table>
<thead>
<tr>
<th>Route</th>
<th>Factors Affecting Absorption</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV (intravenous)</td>
<td>None: direct entry into the venous system</td>
</tr>
</tbody>
</table>
| IM (intramuscular)| Perfusion or blood flow to the muscle  
|                  | Fat content of the muscle  
|                  | Temperature of the muscle: cold causes vasoconstriction and decreases absorption; heat causes vasodilation and increases absorption |
| Sub-Q (subcutaneous)| Perfusion or blood flow to the tissue  
|                  | Fat content of the tissue  
|                  | Temperature of the tissue: cold causes vasoconstriction and decreases absorption; heat causes vasodilation and increases absorption |
| PO (oral)        | Acidity of stomach  
|                  | Length of time in stomach  
|                  | Blood flow to gastrointestinal tract  
|                  | Presence of interacting foods or drugs                                                      |
| PR (rectal)      | Perfusion or blood flow to the rectum  
|                  | Lesions in the rectum  
|                  | Length of time retained for absorption                                                      |
| Mucous membranes (sublingual, buccal) | Perfusion or blood flow to the area  
|                  | Integrity of the mucous membranes  
|                  | Presence of food or smoking  
|                  | Length of time retained in area                                                             |
| Topical (skin)   | Perfusion or blood flow to the area  
|                  | Integrity of skin                                                                           |
| Inhalation       | Perfusion or blood flow to the area  
|                  | Integrity of lung lining  
|                  | Ability to administer drug properly                                                         |

http://www.nursinbuddy.com/2011/02/10/drugs-and-the-body/
PHARMACOKINETICS

Absorption → Distribution → Metabolism → Excretion
Concept of Drug Distribution within the Body:

- **Fat - 25%**: 2.5 mg
- **Plasma - 10%**: 1 mg
- **Plasma Protein - 13%**: 1.3 mg
- **Tissue - 50%**: 5 mg
- **Target Tissue - 2%**: 0.2 mg

10 mg of drug absorbed
METABOLISM

- Biotransformation of the drug
  - Active metabolites (pro-drugs)
  - Inactive metabolites
- Liver, kidney, lungs, intestines, skin, brain, CNS

[Image of the metabolism process]

http://www.doctorfungus.org/thedrugs/antif_interaction.php
PHARMACOKINETICS

Absorption

Distribution

Metabolism

Excretion
EXCRETION-RENAL
EXCRETION

- GI Excretion
  - Unabsorbed drug
  - Metabolites
- Respiratory
  - General anesthetics
- Skin
  - Sweat
- Respiratory
  - General anesthetics

Not to mention…..
- Tears
- Saliva
- Breasts Milk
- Bile
BLOOD LEVELS

Half-Life

- Time it takes concentration of drug to decrease by $\frac{1}{2}$ of the original level

Steady State

- Consistent Blood level

http://apps.who.int/medicinedocs/en/d/Jwhozip23e/7.1.4.3.html

http://www.kinetics.com/pktutorial/1_6.html
THERAPEUTIC INDEX

Therapeutic effect

Toxic effect

ED$_{50}$

TD$_{50}$

Therapeutic index

Narrow TI
PHARMACOKINETICS AFFECTS:

- Onset of action
  - SSRIs

- Peak concentration
  - Aminoglycosides
  - Vancomycin

- Duration of action
DRUG INTERACTIONS

- Drug-drug
- Drug-food
- Drug-herbal
- Drug-labs
DRUG INTERACTIONS

- Drug-drug
- Drug-food
- Drug-herbal
- Drug-labs
Pharmacodynamics

The Good, the Bad and the Ugly!
Medication Guide

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   following symptoms, or call 911 if an emergency, especially if they are new, worse, or worry you:
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   - thoughts about suicide or dying
   - new or worse depression
   - new or worse anxiety or panic attacks
   - feeling agitated, restless, angry or irritable
   - trouble sleeping
   - an increase in activity or talking more than what is normal for you

If you have any of these symptoms, or any other change in how you feel or think, call your doctor right away or go to the nearest emergency room.
FDA Medication Safety Guides

• Primarily Outpatient RX

• Product must have a “serious and significant” public health concern for which patient information is necessary to ensure safe and effective use

• FDA requires a medication guide if one or more exist:
  • Patient labeling could help prevent serious Adverse Events
  • Product has serious risks that could affect patient’s decision to use or continue to use the product
  • Patient adherence to directions is crucial to effectiveness

Adverse Drug Reaction - Definitions

• World Health Organization

  • “A response to a drug which is noxious and unintended, and which occurs at doses normally used in man for the prophylaxis, diagnosis, or therapy of disease, or for the modifications for physiological function”³
Adverse reactions to drugs

Mnemonic: SOAP III

- **Side effect**: Undesirable effect at recommended doses
- **Overdose**: Due to excess dose or impaired excretion
- **Allergy**: Immunologically mediated drug hypersensitivity reaction (DHRs)
  - Specific and re-occurs on re-exposure
- **Pseudoallergy**: Same clinical picture as an allergic reaction but lacking immunological specificity
- **Idiosyncrasy**: A genetically determined abnormal reaction to a drug due to enzyme deficiency
- **Intolerance**: A low threshold to the normal action of a drug
- **Interaction**: One drug affects the effectiveness or toxicity of another drug

Adverse Drug Reactions

• **Adverse Drug Reaction:**
  • Undesirable, harmful response to a medication

• **Serious Adverse Drug Reaction:**
  • Results in death
  • Life threatening
  • Requires inpatient hospitalization or prolongation of existing hospitalization
  • Results in persistent or significant disability or incapacity
Adverse Drug Reactions: Side Effects vs Allergic/Idiosyncratic Response

• Side Effects

  • Enhanced/Diminished action — caused by patient specific parameters effecting pharmacokinetics resulting in a higher/lower blood concentration
    • Kidney failure = increased levels of tobramycin
  • Secondary effects — therapeutic response AND not intended therapeutic response
    • Morphine = Pain AND sedation, respiratory, distress, constipation
    • Benadryl= Antihistamine OR sleep aid because of side effects
  • Toxicity: Ototoxicity with aminoglycosides or furosemide

• Drug allergy: resulting from patient’s immune system

• Idiosyncratic reaction: genetically specific to patient
  • Sensitivity to aspirin causes asthma attack
  • Children taking Benadryl become hyper
Epidemiology of Adverse Drug Reactions

- **Epidemiology**
  - 10–20% of hospitalized patients
  - 25% of outpatients

- **2010 → 2014**
  - ADE originating during hospital stay 39% → 25%
  - ADE presenting on admission 61% → 75%

- **Rule of 10s in ADR**
  - 10% of patients develop ADR
  - 10% of these are due to allergy
  - 10% of these lead to anaphylaxis
  - 10% of these lead to death (0.01-0.1% inpatients)

- **Twice as common in women**
  - Women have a 35% higher incidence of skin ADRs than men.

Epidemiology of Adverse Drug Reactions

• Reaction types:
  - Type A reactions – predictable, most common
  - Type B reactions – unpredictable, less common
    - 10–15% of all ADRs
    - Allergic reactions or (Immune-mediated drug reactions): 6–10% of all ADRs.

• Most common drugs involved
  - Antibiotics and anti-infectives
  - Analgesics: opiates and non-steroidal anti-inflammatory drugs (NSAIDs)
  - Hormones: insulin, steroids, etc.
  - Anticoagulants: warfarin, Eliquis, Xarelto
  - Psychotropic agents
  - Cardiovascular drugs

• Reaction Types
  - Most Common: urticaria and angioedema.
  - Rare: severe and potentially life-threatening reactions
    - toxic epidermal necrolysis,
    - Stevens–Johnson syndrome
    - immune hepatitis.

CIOMS III Working group recommended following categories for description of adverse reaction frequency

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very common</td>
<td>≥ 1/10 (≥ 10 %)</td>
</tr>
<tr>
<td>Common, Frequent</td>
<td>≥ 1/100 and &lt; 1/10 (≥ 1% and &lt; 10%)</td>
</tr>
<tr>
<td>Uncommon, Infrequent</td>
<td>≥ 1/1000 and &lt; 1/100 (≥ 0,1% and &lt; 1%)</td>
</tr>
<tr>
<td>Rare</td>
<td>≥ 1/10000 and &lt; 1/1000 (≥ 0,01% and &lt; 0,1%)</td>
</tr>
<tr>
<td>Very rare</td>
<td>&lt; 1/10000 (&lt; 0,01 %)</td>
</tr>
</tbody>
</table>

**Gabapentin (Neurontin)**

- ** Uses 
  - Seizures 
  - Post – herpetic neuralgia (Shingles) 
  - Neuropathic pain 
  - Diabetic peripheral neuropathy 
  - Fibromyalgia 
  - Post-operative pain (adjunct) 
  - Restless leg syndrome 
  - Hot Flashes 

http://5rings.net/foods-to-reduce-night-time-hot-flashes/
https://www.drjohnbergman.com/disease/shingles/
http://www.metabolic-institute.com/diabetic-peripheral-neuropathy/
https://nsistemcell.com/fibromyalgia-treatment/

Lexicomp; Gabapentin Monograph, accessed 2-19-2015
Common Side Effects 1% to 10%:

- Cardiovascular: Peripheral edema (IR: 2% to 8%; Gralise: 4%), vasodilatation (1%)
- Central nervous system: Hostility (children 5% to 8%), tremor (7%), emotional lability (children 4% to 6%), hyperkinesia (children 3% to 5%), headache (Gralise: 4%; IR: 3%), abnormality in thinking (2% to 3%; children 2%), abnormal gait (2%), amnesia (2%), depression (2%), nervousness (2%), pain (Gralise: 1% to 2%), hyperesthesia (1%), lethargy (Gralise: 1%), twitching (1%), vertigo (Gralise: 1%)
- Dermatologic: Pruritus (1%), skin rash (1%)
- Endocrine & metabolic: Weight gain (IR: Adults and children 2% to 3%; Gralise: 2%), hyperglycemia (1%)
- Gastrointestinal: Diarrhea (IR: 6%; Gralise: 3%), nausea and vomiting (3% to 4%; children 8%), xerostomia (IR: 2% to 5%; Gralise: 3%), constipation (IR: 1% to 4%; Gralise: 1%), abdominal pain (3%), dyspepsia (IR: 2%; Gralise: 1%), dry throat (2%), dental disease (2%), flatulence (2%), increased appetite (1%)
- Genitourinary: Impotence (2%), urinary tract infection (Gralise: 2%)
- Hematologic & oncologic: Decreased white blood cell count (1%), leukopenia (1%)
- Infection: Infection (5%)
- Neuromuscular & skeletal: Weakness (6%), back pain (IR: 2%; Gralise: 2%), dysarthria (2%), limb pain (Gralise: 2%), myalgia (2%), bone fracture (1%)
- Ophthalmic: Nystagmus (8%), diplopia (1% to 6%), blurred vision (3% to 4%), conjunctivitis (1%)
- Otic: Otitis media (1%)
- Respiratory: Rhinitis (4%), bronchitis (children 3%), nasopharyngitis (Gralise: 3%), respiratory tract infection (children 3%), pharyngitis (1% to 3%), cough (2%)
- Miscellaneous: Fever (children 10%)

Lexicomp; Gabapentin Monograph, accessed 2-19-2015
Postmarketing and case reports, <1%:

- Acute renal failure, altered serum glucose, anemia, angina pectoris, angioedema, aphasia, aspiration pneumonia, blindness, blood coagulation disorder, bradycardia, brain disease, breast hypertrophy, bronchospasm, cardiac arrhythmia (various), cardiac failure, cerebrovascular accident, CNS neoplasm, colitis, confusion, Cushingoid appearance, DRESS syndrome, drug abuse, drug dependence, dyspnea, erythema multiforme, facial paralysis, fecal incontinence, gastroenteritis, glaucoma, glycosuria, hearing loss, heart block, hematemesis, hematuria, hemiplegia, hemorrhage, hepatitis, hepatomegaly, herpes zoster, hyperlipidemia, hypertension, hyperthyroidism, hyperventilation, hyponatremia, hypotension, hypothyroidism, hypoventilation, increased creatine phosphokinase, increased liver enzymes, increased serum creatinine, jaundice, joint swelling, leukocytosis, lymphadenopathy, lymphocytosis, memory impairment, meningism, migraine, movement disorder, myocardial infarction, myoclonus (local), nephrolithiasis, nephrosis, nerve palsy, non-Hodgkin's lymphoma, ovarian failure, palpitations, pancreatitis, paresthesia, peptic ulcer, pericardial effusion, pericardial rub, pericarditis, peripheral vascular disease, pneumonia, psychosis, pulmonary thromboembolism, purpura, retinopathy, rhabdomyolysis, seasonal allergy, skin necrosis, status epilepticus, Stevens-Johnson syndrome, subdural hematoma, suicidal ideation, suicidal tendencies, syncope, tachycardia, thrombocytopenia, thrombophlebitis, tumor growth, withdrawal syndrome

Lexicomp; Gabapentin Monograph, accessed 2-19-2015
Very Common Side Effects

• Side Effects >10%:
  • Central nervous system:
    • **Dizziness** (IR: 17% to 28%; children 3%; Gralise: 11%)
    • **Drowsiness** (IR: 19% to 21%; children 8%; Gralise: 5%)
    • **Ataxia** (1% to 13%)
    • **Fatigue** (11%; children 3%)
Common Side Effects

1% to 10%:

- Central nervous system: Hostility (children 5% to 8%), tremor (7%), emotional lability (children 4% to 6%), hyperkinesia (children 3% to 5%), headache (Gralise: 4%; IR: 3%), abnormality in thinking (2% to 3%; children 2%), abnormal gait (2%), amnesia (2%), depression (2%), nervousness (2%), pain (Gralise: 1% to 2%), hyperesthesia (1%), lethargy (Gralise: 1%), twitching (1%), vertigo (Gralise: 1%)

- Gastrointestinal: nausea and vomiting (3% to 4%; children 8%), xerostomia (IR: 2% to 5%; Gralise: 3%) dry throat (2%), dental disease (2%), flatulence (2%)

- Neuromuscular & skeletal: Weakness (6%)

- Ophthalmic: Nystagmus (8%), diplopia (1% to 6%), blurred vision (3% to 4%)

- Otic: Otitis media (1%)

- Respiratory cough (2%)

Lexicomp; Gabapentin Monograph, accessed 2-19-2015
Infrequent, Uncommon, Rare, Very Rare

Post marketing and case reports:

- Aphasia
- Aspiration pneumonia
- Brain disease
- Cerebrovascular accident
- Confusion
- Facial paralysis
- Hearing loss
- Hemiplegia
- Hyperventilation
- Hypoventilation
- Memory impairment
- Movement disorder
- Myoclonus (local)
- Psychosis
- Syncope

Lexicomp; Gabapentin Monograph, accessed 2-19-2015
Citalopram (Celexa)

Uses

- Major Depressive Disorder
- Binge Eating Disorder
- Generalized Anxiety Disorder
- Panic Disorder
- Social Phobia
- Hot Flashes
- Obsessive Compulsive Disorder
- Pathological Gambling

- Alcohol Dependence
- Premenstrual Dysphoric Disorder
- Premature Ejaculation
- Diabetic Neuropathy
• **Side Effects >10%:**
  - Central nervous system: Somnolence (18%; dose related), insomnia (15%; dose related)
  - Gastrointestinal: Nausea (21%), xerostomia (20%)
  - Miscellaneous: Diaphoresis (11%; dose related)

• **Side Effects 1-10%:**
  - Cardiovascular: QT prolongation (2%), hypotension (≥1%), orthostatic hypotension (≥1%), tachycardia (≥1%), bradycardia (1%)
  - Central nervous system: Fatigue (5%; dose related), anxiety (4%), agitation (3%), fever (2%), yawning (2%; dose related), amnesia (≥1%), apathy (≥1%), concentration impaired (≥1%), confusion (≥1%), depression (≥1%), migraine (≥1%), suicide attempt (≥1%)
  - Dermatologic: Rash (≥1%), pruritus (≥1%)
  - Endocrine & metabolic: Libido decreased (1% to 4%), dysmenorrhea (3%), amenorrhea (≥1%)
  - Gastrointestinal: Diarrhea (8%), dyspepsia (5%), anorexia (4%), vomiting (4%), abdominal pain (3%), appetite increased (≥1%), flatulence (≥1%), salivation increased (≥1%), taste perversion (≥1%), weight gain/loss (≥1%)
  - Genitourinary: Ejaculation disorder (6%), impotence (3%; dose related), polyuria (≥1%)
  - Neuromuscular & skeletal: Tremor (8%), arthralgia (2%), myalgia (2%), paresthesia (≥1%)
  - Ocular: Abnormal accommodation (≥1%)
  - Respiratory: Rhinitis (5%), upper respiratory tract infection (5%), sinusitis (3%), cough (≥1%)
<1% postmarketing, and/or case reports:

- Acne, aggressiveness, akathisia, alkaline phosphatase increased, allergic reaction, allergic rhinitis, alopecia, anal itching, anaphylaxis, angioedema, anemia, angina pectoris, arthritis, asthma, ataxia, atrial fibrillation, bilirubinemia, bleeding gums, breast enlargement, breast pain, bronchitis, bronchospasm, bruising, bruxism, bundle branch block, burstitis, cardiac arrest, cardiac failure, cataracts, catatonia, cellulitis, cerebrovascular accident, cholecystitis, cholelithiasis, choreoathetosis, coagulation abnormalities, colitis, conjunctivitis, coordination abnormal, dehydration, delirium, delusions, dependence, depersonalization, dermatitis, diplopia, diverticulitis, dry eyes, dry skin, duodenal ulcer, dyskinesia, dysphagia, dystonia, dysuria, eczema, emotional lability, epidermal necrolysis, epistaxis, eructation, erythema multiforme, esophagitis, euphoria, extrapyramidal symptoms, extrasystoles, eye pain, facial edema, flu-like syndrome, flushing, gait instability, galactorrhea, gastric ulcer, gastritis, gastroenteritis, gastroesophageal reflux, gastrointestinal hemorrhage, gingivitis, glaucoma, glossitis, glucose tolerance abnormal, goiter, granulocytopenia, gynecomastia, hallucinations, hematuria, hemorrhoids, hemolytic anemia, hepatic necrosis, hepatitis, hiccups, hot flashes, hyper-/hypoesthesia, hyper-/hypokinesia, hyperpigmentation, hypertension, hypertonia, hypertrichosis, hypochromic anemia, hypoglycemia, hypokalemia, hyponatremia, hypothyroidism, involuntary muscle movement, jaundice, keratitis, lacrimation abnormal, laryngitis, leg cramps, libido increased, leukocytosis, leukopenia, liver enzymes increased, lymphadenopathy, lymphocytosis, lymphopenia, muscle weakness, myocardial infarction, myocardial ischemia, mydriasis, myoclonus, neuralgia, neuroleptic malignant syndrome, nightmares, nystagmus, obesity, oliguria, osteoporosis, panic attacks, paranoia, pancreatitis, peripheral edema, phlebitis, photophobia, photosensitivity, pneumonia, pneumonitis, priapism, prolactinemia, prothrombin decreased, psoriasis, psychosis, ptosis, pulmonary embolism, purpura, pyelonephritis, renal calculi, renal failure, renal pain, rhabdomyolysis, rigors, seizures, serotonin syndrome, SIADH, skeletal pain, skin discoloration, spontaneous abortion, stomatitis, stupor, sweating decreased, syncope, thirst, thrombocytopenia, thrombosis, tinnitus, torsade de pointes, transient ischemic attack, urinary incontinence, urinary retention, urticaria, vaginal bleeding, ventricular arrhythmia, vertigo, withdrawal syndrome
Very Common

• Side Effects >10%:
  • Central nervous system:
    • Somnolence (18%; dose related),
    • Insomnia (15%; dose related)
  • Gastrointestinal:
    • Xerostomia (20%)

Lexicomp; Citalopram Monograph, accessed 2-19-2015
Common

• Side Effects 1-10%:

  • Cardiovascular:
    • Hypotension (≥1%)
    • Orthostatic hypotension

  • Central nervous system:
    • Fatigue (5%)
    • Agitation (3%)
    • Amnesia
    • Concentration impaired
    • Confusion

  • Gastrointestinal:
    • Anorexia (4%)
    • Salivation increased (≥1%)
    • Taste perversion (≥1%)

  • Neuromuscular & skeletal:
    • Tremor (8%)
    • Paresthesia (≥1%)

  • Respiratory:
    • Cough (≥1%)

Lexicomp; Citalopram Monograph, accessed 2-19-2015
Infrequent, Rare, Very Rare

- Aggressiveness
- Akathisia
- Ataxia
- Bruxism
- Catatonia
- Cerebrovascular accident
- Coordination abnormal
- Dehydration
- Delirium
- Delusions
- Depersonalization
- Dyskinesia
- Dysphagia
- Dyspnea
- Dystonia
- Euphoria
- Extrapyramidal symptoms
- Gait instability

- Hallucinations
- Hyper or hypokinesia
- Hypoglycemia
- Involuntary muscle movement
- Muscle weakness
- Myoclonus
- Neuralgia
- Nightmares
- Nystagmus
- Panic attacks
- Paranoia
- Psychosis
- Stomatitis
- Stupor
- Syncope
- Thirst
- Vertigo
### Adverse Drug Reactions Resources

#### Pharmacologic Category

<table>
<thead>
<tr>
<th>Pharmacologic Category</th>
<th>Most Common Use</th>
<th>Drug/Drug Class Name - By Generic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antiretroviral</td>
<td>HIV</td>
<td>Abacavir</td>
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<tr>
<td>Antiretroviral</td>
<td>HIV</td>
<td>Abacavir/Lamivudine</td>
</tr>
<tr>
<td>Parathyroid Hormone Analog</td>
<td>Osteosarcoma</td>
<td>Abaloparatide</td>
</tr>
<tr>
<td>Glycoprotein III/II Inhibitor</td>
<td>Prevention of Cardiac Ischemia</td>
<td>Abciximab</td>
</tr>
<tr>
<td>Antineoplastic Agent</td>
<td>Breast cancer</td>
<td>Abemaciclib</td>
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<tr>
<td>Neurovascular Blocker Agent</td>
<td>Cerebral Dystonia</td>
<td>AbobotulinumtoxinA</td>
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<tr>
<td>GABA Antagonist/Agonist</td>
<td>Alcohol Abstinence</td>
<td>Acamprosate</td>
</tr>
<tr>
<td>Analgesic Combination</td>
<td>Moderate to Severe Pain</td>
<td>Acetaminophen/Caffeine/Dihydrocodeine</td>
</tr>
<tr>
<td>Carbonic Anhydrase Inhibitor</td>
<td>Glaucoma</td>
<td>Acetazolamide</td>
</tr>
<tr>
<td>Retinoid-Like Compound</td>
<td>Photoallergy</td>
<td>Acitretin</td>
</tr>
<tr>
<td>Anticholinergic Agent</td>
<td>COPD</td>
<td>Acclidinium</td>
</tr>
<tr>
<td>Antiviral Agent</td>
<td>Herpes Simplex Virus</td>
<td>Acyclovir</td>
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<tr>
<td>Vaccine</td>
<td>Acute Febrile Respiratory Disease</td>
<td>Adenovirus (Type 4, 7) Vaccine</td>
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<tr>
<td>Monoclonal Antibody</td>
<td>Cancer</td>
<td>Ado-Trastuzumab</td>
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<tr>
<td>Enzyme</td>
<td>Fabry Disease Replacement Therapy</td>
<td>Agalsidase Beta</td>
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<tr>
<td>Anthelminic</td>
<td>Parasitic Worms</td>
<td>Albendazole</td>
</tr>
<tr>
<td>Beta 2 Agonist</td>
<td>Asthma, COPD</td>
<td>Albuterol</td>
</tr>
</tbody>
</table>
Drugs causing Tinnitus

European Review for Medical and Pharmacological Sciences

Pharmacological drugs inducing ototoxicity, vestibular symptoms and tinnitus: a reasoned and updated guide

G. Cianfrone¹, D. Pentangelo¹, F. Cianfrone², F. Mazzei¹, R. Turchetta¹, M.P. Orlando¹, G. Altissimi¹

¹Department of Otolaryngology, Audiology and Phoniatrics, “Umberto I” University Hospital, Sapienza University, Rome (Italy);
²Institute of Otorhinolaryngology, School of Medicine, Catholic University of the Sacred Heart, Rome (Italy)
Pharmacological drugs inducing ototoxicity, vestibular symptoms and tinnitus

Index B

In this index the active principles are listed in alphabetical order, each with a numerical reference to the relevant type of side effect. Whenever possible according to data available to us, believing it to be very useful, we indicated the side effect frequency for each drug using a grading scale from a to e going from “very common” to “very rare” (see page 609).

<table>
<thead>
<tr>
<th>Reference numbers</th>
<th>Drugs classes</th>
<th>ADR</th>
<th>Reference numbers</th>
<th>Drugs classes</th>
<th>ADR</th>
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<tbody>
<tr>
<td>1</td>
<td>Abacavir + Lamivudine</td>
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<td>52</td>
<td>Aztreonam</td>
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<td>Abacavir</td>
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<td>53</td>
<td>Bacitracin + Neomycin</td>
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<tr>
<td>3</td>
<td>Abacavir + Lamivudine + Zidovudine</td>
<td>3</td>
<td>54</td>
<td>Baclofen</td>
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<tr>
<td>4</td>
<td>Acebutolol</td>
<td>3b</td>
<td>55</td>
<td>Benazepril + Hydrochlorothiazide</td>
<td>2c,3b</td>
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<td>5</td>
<td>Aceclidine + Timolol Maleate</td>
<td>2,3</td>
<td>56</td>
<td>Benazepril Hydrochloride</td>
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<td>6</td>
<td>Aceclofenac</td>
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<td>Betamethasone + Bekanamicin + Tetryzoline</td>
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<td>7</td>
<td>Acetazolamide</td>
<td>3,4</td>
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<td>Betamethasone + Tetryzoline</td>
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<td>8</td>
<td>Acetylsalicylic Acid</td>
<td>1</td>
<td>58</td>
<td>Betamethasone</td>
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<td>9</td>
<td>Acetylsalicylic Acid + Magnesium</td>
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<td>59</td>
<td>Betamethasone + Clorfenamin</td>
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<td>Acyclovir</td>
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<td>60</td>
<td>Bezafibrate</td>
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<td>11</td>
<td>Adalimumab</td>
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<td>61</td>
<td>Biperiden Hydrochloride</td>
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<td>12</td>
<td>Adrenalin</td>
<td>3</td>
<td>62</td>
<td>Bisoprolol Fumarate</td>
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<tr>
<td>13</td>
<td>Agalsidase Alfa - Beta</td>
<td>2,3</td>
<td>63</td>
<td>Bisoprolol Fumarate + Diuretics</td>
<td>3c</td>
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<tr>
<td>14</td>
<td>Alfacalcidol</td>
<td>3</td>
<td>64</td>
<td>Botulinum Toxin A</td>
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<td>15</td>
<td>Alfentanil</td>
<td>3</td>
<td>65</td>
<td>Brimonidine Tartrate + Timolol</td>
<td>3c</td>
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<tr>
<td>16</td>
<td>Alfuzosin Hydrochloride</td>
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<td>66</td>
<td>Brimonidine Tartrate</td>
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<td>17</td>
<td>Alizapride Hydrochloride</td>
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<td>Brinzolamide</td>
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<td>Allopurinol</td>
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<td>Bromazepam</td>
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<td>19</td>
<td>Almotriptan</td>
<td>2c,3b</td>
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<td>Bromocriptine Mesylate</td>
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<td>Alpha 1 Antitrypsin</td>
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<td>Bromperidol</td>
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<td>21</td>
<td>Alprazolam</td>
<td>3b</td>
<td>71</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Drug Interactions

• Drug-drug
  • Oral contraceptives and antibiotics
  • Xanax and Ativan
  • Cipro and calcium (dairy products)

• Drug-food
  • MAO inhibitors and foods with Tyramine
  • Warfarin (Coumadin) foods containing Vitamin K

• Drug-herbal
  • MAO inhibitors and Kava or St Johns Wart increase risk of serotonin syndrome

• Drug-labs
  • EKGs
  • False positive or negative on blood tests
DRUGS THAT AFFECT

- Swallowing (aphagia, dysphagia)
- Balance
- Hearing (ototoxicity, tinnitus)
- Cognition
- Movement
- Speech (apraxia, aphasia,)

http://laoblogger.com/dysphagia-clipart.html
DRUG INDUCED DYSPHAGIA

- No apparent abnormality of esophageal transit
- No prior esophageal disease
Consider:

- When is med taken? Bedtime?
  - Inadequate fluid to swallow medication
  - Decreased swallowing, saliva, peristalsis
- Size and shape of tablets and capsules
  - 2cm tablets more delayed than <1cm

Elderly patients

- More meds
- More likely to have anatomic or motility abnormalities of esophagus
- More likely to have cardiac enlargement with concomitant compression of mid-esophagus
- Motility problems due to diabetes or autonomic neuropathy
- Swallowing dysfunction due to stroke or connective tissue disease
- Decreased saliva leading to decreased esophageal lubrication and increased likelihood of the drug to the esophageal mucosa

DRUG INDUCED DYSPHAGIA

- Drugs acting on CNS
  - Sedatives
  - Narcotics

- Drugs acting on striated muscle
  - Muscle relaxants (pancuronium, succinylcholine)
  - Local Anesthetics (benzonatate, Tessalon Perles)

- Extrapyramidal motor movements
  - Antipsychotics

- Xerostomia
DRUG INDUCED DYSPHAGIA

- Alcohol

- Cytotoxic agents
  - Predispose patient to viral and fungal infections
  - Esophagitis

- Drug Induced Esophageal Injury
  - Drugs with pH <3
    - Doxycycline, tetracycline, ascorbic acid, ferrous sulfate
  - Esophagitis or esophageal stricture formation
    - NSAIDs, low dose aspirin
DRUG INDUCED DYSPHAGIA

- Alleviate problem
- Correctly formulated drug
  - Sublingual, buccal or dissolvable tablets
  - Liquid preparations
- Timing of medication administration
WHEN TO SUSPECT MEDICATION IN HEARING LOSS

- Patient has history of:
  - Cancer
  - Renal Disease
  - Infection

- Risk Factors for Ototoxic Reactions:
  - Patient populations more vulnerable
    - Extremes in age (very young or very old)
    - Renal or Hepatic Failure
  - Rapid IV infusion rates
  - High-dose regimens
  - Lengthy duration of treatment
  - Combination of ototoxic drugs

OTOTOXICITY - Aminoglycosides

- Incidence is 5-10%
- Mechanism of toxicity
  - Cells affected
    - Outer Hair cells (high frequency hearing) affected first
    - Inner hair cells damaged with continued exposure
  - Drug Accumulation in Inner ear
    - Active transport
    - Elimination ½ life
      - Single Dose – 10-13 days
      - Multiple Doses – 30 days
  - Mitochondrial ribosomes
    - Resemble bacterial ribosomes

OTOTOXICITY- Aminoglycosides

• Vestibular toxicity

• Gentamicin, tobramycin, streptomycin
  • May or may not have hearing loss
  • Usually noted with standing up, sitting down, during head movement or when eyes are closed
  • Adaption often develops over 2 weeks to 2 months

• Cochlear Toxicity

• Amikacin, kanamycin, tobramycin, neomycin
  • Irreversible, occurs within 2-6 days of therapy initiation or discontinuation, may not be evident for several weeks

https://twitter.com/dr_banderology/status/857377622380220416
Love et al. Ototoxicity and Vestibulotoxicity Considerations in Primary Care; Clinician Review; April 2013
Aminoglycoside Toxicity

• Genetic predisposition –
  • A155G mutation in mitochondrial genome
  • Results in human 12S rRNA to look like bacterial 16S rRNA
  • Aminoglycoside target in the bacterial 16S rRNA
  • Greater affinity for 12S rRNA causing ototoxicity

• Ethnic implications -- A1555G DNA mutation
  • 10-33% of Asians with ototoxicity
  • 17% of white patients
    • Overall prevalence in white patients is 0.2%

Ototoxicity – Miscellaneous Antibiotics

- Erythromycin/Macrolides (20-30%)
  - Erythromycin
    - “blowing sound” with vertigo
    - Begin 4 – 8 days into high dose therapy and resolve in days to weeks of discontinuation
  - Vancomycin (??)
    - “Mississippi Mud”
    - High frequency hearing loss with tinnitus
      - Rare to infrequent – combination with other ototoxic drugs?
  - Minocycline
    - Dose dependent, reversible vestibulotoxicity
      - 75mg twice daily – 50% patients
      - 100mg twice daily – 100% patients develop vertigo
      - Incidence is 2-3 times in female > male
      - Resolves with 48 hrs of drug discontinuation in 75% of patients

Love et al. Ototoxicity and Vestibulotoxicity Considerations in Primary Care; Clinician Review; April 2013
OTOTOXICITY

Platinum-based Anticancer Drugs

• “Penicillin of Cancer”
  • 40% of all chemotherapeutic regimens
  • Cis-platin, carboplatin and oxaliplatin

• Used to treat pediatric and adults
  • Solid tumors
    • Neuroblastoma, germ cell tumors, osteosarcoma, brain tumors, testicular cancer, ovarian cancer, endometrial cancer, lung cancer, or head and neck cancers
  • Platination of mitochondrial DNA and proteins
    • Affects cell respiration
    • Induces ROS
    • Irreversible damage causes apoptosis of cells

OTOTOXICITY - Cisplatin

- Neurotoxicity, nephrotoxicity and ototoxicity is dose limiting to therapy

- Hearing loss
  - Begins outer hair cells affecting higher frequencies
  - Progresses to inner hair cells affecting lower frequencies
  - Starts days to weeks into therapy
  - Usually bilateral

- Tinnitus
  - Occurs in 25-50% patients
  - Lasts for at least a year in 38% of cases
RISK FACTORS

- Dose, Route, Duration of therapy
  - Bolus more toxic than short or continuous infusion
  - Size of dose
  - Cumulative cisplatin dose
- Children $\leq 4$ years
- Simultaneous cranial irradiation
- Noise exposure
- Administration with other ototoxic drugs (loop diuretics, aminoglycosides)
- Administration of carboplatin
- Pre-existing hearing impairment
- Renal insufficiency

OTOTOXICITY - Cisplatin

• Genetic predisposition –
  • Ototoxicity
    • Genes involved in detoxification (GSTs)
    • Proteins involved in transports of cisplatin (OCT2 or CTR1)
  • PROTECTION from OTOTOXICITY
    • Adults with testicular cancer
      • Deletion of GSTT1 allele and/or GSTP1 polymorphism (SNP)rs1695
      • Carry the SNP rs3316019 of the OCT2 gene
    • Children
      • GSTM3 SNP rs1799735
      • Carry the SNP rs3316019 of the OCT2 gene

• OBSERVATIONS NEED TO BE CONFIRMED

OTOTOXICITY

- NSAIDS
  - Aspirin, Indomethacin, Ibuprofen
    - Ototoxicity: 0.3% to 1.7% in patients > 2.7g/day
    - Tinnitus: 50% of patients taking > 4g/day
    - Hearing loss: 25% of patients taking > 4g/day
    - Reversible,
      - due to interference at enzymatic level.
      - Reduction in blood flow from vasoconstriction

- Loop Diuretics (furosemide, bumetanide, torsemide, ethacrynic acid)
  - Dose dependent or rapid IV infusion
  - Affects the Na-K-Cl transport system
  - Decreased blood flow

- Drugs for Erectile Dysfunction (Viagra, Cialis)
  - Sudden hearing loss
  - Vertigo, dizziness, tinnitus

Love et al. Ototoxicity and Vestibulotoxicity Considerations in Primary Care; Clinician Review; April 2013
BALANCE AND VERTIGO

- Balance
  - Vision
  - Inner Ear
  - Cerebellum
  - Proprioceptive pathways
  - Vasovagal system

- Vertigo
  - Unbalanced input by central vestibular apparatus
  - Unbalanced processing of vestibular visual and somatosensory inputs

http://www.emedmd.com/content/vertigo-and-imbalance
Lin E, Aligne K, Pharmacology of balance and dizziness, NeuroRehabilitation 32(2013) 529-542
DRUGS THAT CAUSE DIZZINESS

- Antibiotics
  - Aminoglycosides
  - Tetracyclines

- Antihypertensives
  Orthostatic Hypotension
  - Clonidine
  - Metyldopa
  - Phentolamine
  - Nifedipine
  - Ranolazine
  - Labetalol

- Diuretics
  - Furosemide, bumetanide
  - Hydrochlorothiazide

- Antipsychotics
  - Phenothiazines

- Antidepressants
  - SSRIs (SE and upon discontinuation)
  - TCAs (orthostatic hypotension)
  - SNRIs
  - Bupropion (Wellbutrin®)

Lin E, Aligne K, Pharmacology of balance and dizziness, NeuroRehabilitation 32(2013) 529-542
DRUGS THAT CAUSE DIZZINESS

- **Anticonvulsants**
  - Ethosuximide, levetiracetam, tiagabine, vigabatrin, lacosamide
  - Gabapentin and pregabalin (ataxia)
  - Lamotrigine (diplopia)
  - Retigabine (blurred vision)

- **Sedative/Hypnotics**
  - Ramelteon
  - Buspirone
  - Flumazenil

- **Chemotherapy Drugs**
  - Vertigo without ototoxicity
    - Cetuximab
    - Dasatinib
    - Imatinib
    - Sunifinib
    - Tàxtuzeumab
    - Tretinioin
    - Mefanamic acid
    - Azathiprine
    - Tacrolimus
    - Natalizumab

- **Hypotension**
  - Etoposide
  - Docetaxel
  - Bortezomib

DRUGS THAT CAUSE DIZZINESS

ALCOHOL
CAFFEINE
NICOTINE

Lin E, Aligne K, Pharmacology of balance and dizziness, NeuroRehabilitation 32(2013) 529-542
https://www.etsy.com/market/nicotine_t_shir
OTOTOXICITY - PROTECTION

- N-acetylcysteine
  - Antioxidant prevents apoptosis of cells caused by aminoglycosides
  - Prevents ROS formation
  - 3 trials, 146 patients, dialysis patients

- Statin drugs
  - Simvastatin - Protection in vitro in a rats
  - Atorvastatin – case report of irreversible ototoxicity

Brand et al. BMC Neuroscience 2011, 12:114
OTOTOXICITY - PROTECTION

- Prevent hair cell death by acting at different points in cell death pathway
  - Melatonin – potent antioxidant and free radical scavenging hormone
  - Dexamethasone – anti-inflammatory, anti-allergy drug that inhibits AP-1
  - Tacrolimus – immunosuppressant that limits formation of AP-1

- Activating Protein-1 (AP-1)
  - Gentamicin increases AP-1 activity in outer hair cells
Development of local long-term delivery techniques to the cochlea will be a breakthrough in terms of reducing the levels of drugs required for effective treatment, decreasing or eliminating side effects and avoiding alteration of drugs by liver metabolism, thereby assuring that the desired concentration of a drug is achieved only in the target area 9ie, the perilymph within the scala tympani. The results of our study show that local treatment of cochlea with dexamethasone, melatonin or tacrolimus can conserve auditory function and prevent hair cell loss.
Clinical Trials - Sensorion

- SENS 401 (R-azasetron besylate)
  - Orphan Drug Status – platinum induced ototoxicity in pediatric patients
    - US Food and Drug Administration (August 2017)
    - European Medicines Agency
  - Mechanism
    - 5HT3 and calcinuerin inhibition
      - To protect against inner ear lesions that lead to nerve degeneration and hair cells loss
  - Phase 1: complete
  - Phase 2: preparing to begin
Clinical Trials - Sensorion

- Seliforant (formerly SENS-111)
  - histamine H4 receptor antagonist
    - treatment of vertigo of vestibular origin
    - treat acute unilateral vestibulopathy (AUV)
  - neuromodulation effect of the sensorineural inner ear cell function
    - orally or injection

- Phase 2 trial
  - United States
  - Europe
  - South Korea
TINNITUS

Supplements
- Lipo-Flavonoid (BVitamins, Vitamin C)
- Quietus, RingStop (homeopathic dilutions of cinchona)
- Ginkgo biloba
- Melatonin
- Zinc

Traditional treatments
- NO DRUGS APPROVED FOR TINNITUS
- Antidepressants (TCAs, SSRIs)
- Benzodiazepines (alprazolam)
- Anticonvulsants (carbamazepine, gabapentin)
- Glutamate Antagonists (memantine, acamprosate)
TREATING TINNITUS

Lifestyle Modifications

Avoid:
- Salt
- Caffeine
- Simple Sugars
- MSG
- Artificial Sweeteners
- Food dyes

- Therapy
  - Cognitive Behavioral Therapy
  - Counseling
  - Sound therapy
  - Meditation
TREATING DIZZINESS AND BALANCE DEFICIENCIES

Suppress Vestibular System:

- Antihistamines
  - Meclizine (anticholinergic, antiemetic)
  - Dimenhydrinate (Dramamine)
- Anticholinergics
  - Scopolamine (Transderm Scop)
  - Atropine
- Benzodiazepines
  - Diazepam (Valium)
  - Lorazepam (Ativan)
  - Clonazepam (Klonipin)
- Calcium Channel Antagonists
  - Nimodipine

Manage Symptoms of Nausea:

- Phenothiazines
  - Prochlorperazine (Compazine)
  - Promethazine (Phenergan)
- Metoclopramide (Reglan)
- Ondansetron (Zofran)

Lin E, Aligne K, Pharmacology of balance and dizziness, NeuroRehabilitation 32(2013) 529-542
TREATING DIZZINESS AND BALANCE DEFICIENCIES

- Baclofen
  - Used in patients with microvascular compression of CNVIII
    - Vestibulocochlear nerve

- Amantadine
  - Promote compensation in patients with brain injury

Lin E, Aligne K, Pharmacology of balance and dizziness, NeuroRehabilitation 32(2013) 529-542
Applying to Patient/Client Care

Using what we have learned....and more useful stuff I haven’t told you yet!
Case

• SQ is a 27 yo female who has just learned she has Hodgkin's lymphoma. The doctor has informed her she is also pregnant and it was determined she is 8 weeks into the pregnancy. Chemotherapy will consist of:
  • Doxorubicin
  • Bleomycin
  • Vinblastine
  • Dacarbazine

• Past medical history and additional medications consist of:
  • Prenatal vitamins
  • Levothyroxine (Synthroid) for hypothyroidism
  • Paroxetine (Paxil) for depression associated with Hodgkin’s Lymphoma dx
  • Valproic Acid (Depakote) and Carbamazepine (Tegretol) for seizure disorders
Chemotherapy

1 in 1000 pregnant patients receive a cancer diagnosis

Study of cases recorded in the Cancer and Pregnancy Registry

- 35 patients received chemo after 12 weeks
- 22 patients didn’t receive chemo

No demonstrated significant difference in cognitive ability, school performance or behavioral competence between the children

Patients taking chemotherapy had increased risk of prematurity (36-38 weeks)

Prematurity did not predict developmental outcomes

**SSRI antidepressants (Paxil)**

- Evaluation of short and long term use of SSRI
- Norwegian Cohort 45,266 women having 51,748 pregnancies
  - 373 women used SSRI during pregnancy
  - 161 women used for at least 2 trimesters

- Children of patients taking SSRI were at greater risk of language delay at age 3

- Patients with anxiety and depression had increased risk of language delay

- Very few of the children could be classified as having clinically impaired language

- Based on these findings it is important to treat women for depression as indicated

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*S Skurvoll, R Selmer, et al. “Prenatal exposure to antidepressants and language competence at age three: results from a large population-based pregnancy cohort in Norway”; Royal College of Obstetricians and Gynaecologists; DOI 10.111/1471-0528.12821; www.bjog.org; 2014*
<table>
<thead>
<tr>
<th>Anti Seizure Medications</th>
<th>Cognitive Impairment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbamazepine</td>
<td>Pregabalin</td>
</tr>
<tr>
<td>Clonazepam</td>
<td>Primidone</td>
</tr>
<tr>
<td>Gabapentin</td>
<td>Retigabine</td>
</tr>
<tr>
<td>Lacosamide</td>
<td>Rufinamide</td>
</tr>
<tr>
<td>Lamotrigine</td>
<td>Sodium valproate</td>
</tr>
<tr>
<td>Levetiracetam</td>
<td>(Valproic Acid)</td>
</tr>
<tr>
<td>Oxcarbazepine</td>
<td>Tiagabine</td>
</tr>
<tr>
<td>Phenobarbital</td>
<td>Topiramate</td>
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<tr>
<td>Phenytoin</td>
<td>Vigabatrin</td>
</tr>
<tr>
<td></td>
<td>Zonisamide</td>
</tr>
</tbody>
</table>
Anti Seizure Medications

- Observational Study through Australian Pregnancy Register for Women with Epilepsy and Allied Disorders identified 102 ChildrenExposed prenatally to Antiepileptic Drugs

- Valproic Acid (VPA)
  - Decreased IQ in preschool children
  - Decreased Verbal IQ in older children

- Parent reports suggest
  - Children are at risk for poor adaptive behavior
  - Need educational assistance

- Polytherapy with VPA had highest risk
- Higher the dose, increased risk of developmental delay
- Monotherapy with Carbamazepine (CBZ) or Lamotrigine (LAM) was not statistically different than norms
- Polytherapy without VPA had higher risk than CBZ and LAM but significantly below expected levels

C Nadebaum, VA Anderson et. al. “Language skills of school-aged children prenatally exposed to antiepileptic drugs”, Neurology; 2011; 76:719-726
Case

- ML is a 12 year old girl is referred to you by her school with the following complaints
  - Increased irritability
  - Agitation
  - Memory difficulties
  - Difficulty retrieving words

- Significant Medical History:
  - Pediatrician diagnosed ADD and prescribed Methylphenidate (Concerta) 27 mg every morning for ADHD
  - Migraines over the last year developing to at least 2 -3 times a week. Pediatrician started her on Topiramate 25mg at night increasing by 25mg /week to a total of 100mg a night. (1 year)
  - Citalopram (Celexa) for anxiety and depression. (4 weeks)
  - 10 pound weight loss over last 6 months
• **Social History**
  - Missed 20 days of school due to migraines last year and is repeating 5th grade
  - Parents divorced over the summer with 50/50 custody agreement

• **School Testing**
  - TOVA within normal limits
  - Conners Behavior Rating Scales were significant for somatic complaints, separation anxiety, academic difficulties

• Based on this limited history, what are possible concerns??
Role of Speech Language Pathologist

- Psychoactive medications play a role in treating children
- SPLs will spend more time with child than prescriber
  - Able to identify subtle changes in
    - Side effects
    - Behaviors
- Important to evaluate child’s behavior
  - Prior to beginning new medications or changing doses
  - When evaluating problematic behavior

- When medications are prescribed
  - Monitor for efficacy, tolerability and side effects
Methylphenidate

- Prescribed prior to school testing
- Testing and parent/teachers/student evals not significant for ADD
- SE of Methylphenidate
  - Agitation
  - Anxiety
  - Irritability

- Plan?
Celexa

- Medication started based on child’s mood secondary to parent’s divorce
  - Depression
  - Separation Anxiety

- Potential Side Effects
  - Anxiety / agitation during first 2-4 weeks of therapy, will resolve
  - Amnesia
  - Impaired concentration
  - Confusion

- Plan?
Topiramate

- “Dopamax”

- Numerous studies with doses as low as 25mg/day report impaired cognition with topiramate
- Increase dose, increase side effects

- Side Effects:
  - Memory impairment (short term)
  - Speech/fluency problems
  - Difficulty retrieving words/ verbal recall
  - Attention/concentration deficit
  - Psychomotor slowing
Synergy – Isn’t always a good thing

• Weight loss – methylphenidate and topiramate
• Cognition – topiramate and celexa
• Agitation, irritation – methylphenidate and celexa
• Fatigue – topiramate and celexa
Case

- BAD is a 39 yo male who comes to your clinic complaining of hearing loss in his left ear. He said he woke up yesterday morning and couldn’t hear anything with his left ear. He doesn’t report any vertigo or tinnitus.

- Past medical history is significant for:
  - Recent hospitalization for Hospital Acquired Pneumonia (pseudomonas and MRSA) post influenza
    - Medications during hospital stay
      - Vancomycin 1.25g q 8 h x10 days (antibiotic)
      - Amikacin 1.5g q 24 h x10 days (antibiotic)
      - Furosemide 40mg q 12 h IV acute kidney injury and volume overload
  - Hypertension (BP 150/92)
    - Lisinopril 40mg daily
    - Hydrochlorothiazide 25mg daily
  - Pain secondary to motorcycle accident
    - Goody powders 1-2 packets q 4 hr
  - Erectile Dysfunction
    - Cialis 5mg daily
What do you think is going on with Mr. BAD??

When to suspect medication in Hearing loss

• Patient has history of
  • Cancer
  • Renal Disease
  • Infection
LED is a 56-year-old female complaining of incessant ringing in her ears. Her primary care physician has diagnosed tinnitus and arranged for her to come to your clinic. Ms. D says she is having trouble hearing her husband during conversation and she reports 4 episodes of severe vertigo over the last 20 years but assumes it has to do with sinus congestion associated with allergies and changes in the weather. Your evaluation reveals loss of hearing the lower range frequencies on the left side more than the right, ABR is negative.

Past medical history is significant for:
- Hypothyroidism
- Depression
- Asthma
- Elevated SrCr post NSAID use (stopped 2013)
- Gravida 2

Past surgical history
- Cholecystectomy in 2003
- Bilateral lumbar discectomy 2001
- Thoracic lumbar fusion 2011
- Surgical fixation of tibial plateau fracture 2017
Case

- **Current medications:**
  - Zyrtec 10mg daily
  - Levothyroxine 200mcg daily
  - Duloxetine 60mg daily
  - Wellbutrin XR 150mg daily
  - Q-Var 2 puffs twice daily
  - Vit D3 2000mg daily

- What do you think about the history of vertigo?
- What are the potential causes of her tinnitus? Hearing loss?
- What would you recommend for treatment?
Vertigo

- PMH: cyclobenzaprine, gabapentin, ibuprofen, lanzoprazole, modafanil, clonazepam, metoprolol, meloxicam, oral progestin contraceptive, celexa
- Duloxetine
- Wellbutrin
- Zyrtec

http://www.vertigoexpert.org/vertigo
What’s up with Ms. D

- Hearing loss
- PMH positive for azithromycin, erythromycin, ciprofloxacin

[Image: Girl holding a cup with the text "CAN U HEAR ME NOW?" written on a chalkboard.]
Tinnitus

- **PMH** spinal anesthesia, cyclobenzaprine, doxycycline, gabapentin, ibuprofen, meloxicam, citalopram
- Duloxetine
- Wellbutrin
- Zyrtec
Mr and Mrs D have been married for 62 years. They have lived in their current home for over 20 years and enjoyed their independence. They recently moved into assisted living due to Mrs. D’s limited ability to ambulate. After breaking a hip 4 years ago Mrs. D (89yo) no longer drives, but Mr. D (88) enjoys sporting her around in his convertible Mustang for ice cream, sunsets, and the necessary trips to the doctor.

They are slowing down and not as spry as they used to be which causes them frustration. Mr. D is easily discouraged by all the medication Mrs. D insists he take every day.
Mrs D Medical History

- Heart failure secondary to aortic valve failure
  - Status Post
    - TAVRE mitral valve repair 2/2017
    - Aortic clip 12/2017
- Stage 3 kidney disease
- Diabetes
- Hypertension
- Hypothyroidism
- Hypercholesterolemia
- Cardio neurogenic syncope
- Previous surgeries include
  - Hip repair
  - Foot surgery
Mrs D’s Medications (18 doses of med/day)

- Metoprolol
- Hydralazine
- Levothyroxine
- Sertraline (BID)
- Lansoprazole
- Niacin ER
- Latanprost (glaucoma eyedrops)
- Furosemide
- Potassium Chloride
- Aspirin
- Allopurinol
- Sensipar
- Preservision
- Vit D3
- Glucosamine Chondroitin
- Centrum Silver
Mr D’s Medical History

- Hypertension
- Heart failure
- Hypercholesterolemia
- GERD
- Restless Leg Syndrome
- COPD
- Depression (remission)

- Complains of feeling dizzy when he stands up and it sometimes takes several minutes for dizziness to go away
Mr D’s Drugs (22 doses of med/day)

- Carvedilol
- Losartan
- Pravastatin
- Amiodarone
- Lansoprazole
- Xarelto
- Ferrous Sulfate
- Venlafaxine
- Pramipexole

- Aspirin
- Vitamin B12
- Centrum Silver
- Fish Oil
- Ferrous sulfate
- Glucosamine Chondroitin
- Vitamin D3
- Tylenol PM prn
The Beers Criteria for Potentially Inappropriate Medication (PIMs) Use in Older Adults, commonly called the Beers List, are guidelines for healthcare professionals to help improve the safety of prescribing medications for older adults.

American Geriatrics Society 2015 Updated Beers Criteria for Potentially Inappropriate Medication Use in Older Adults

By the American Geriatrics Society 2015 Beers Criteria Update Expert Panel
<table>
<thead>
<tr>
<th>Drugs and Categories of Drugs</th>
<th>Why these drugs may be inappropriate for older adults</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anticholinergic drugs—these drugs can cause side effects such as confusion, hallucinations, sleepiness, blurred vision, difficulty urinating, dry mouth and constipation in older adults.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Antihistamines—drugs that are typically prescribed for allergies, hives and eczema:  
  • Brompheniramine  
  • Carbinoxamine  
  • Chlorpheniramine  
  • Clemastine  
  • Cyproheptadine  
  • Dextromethorphan  
  • Dexamfetamine  
  • Diphenhydramine (oral)  
  • Doxylamine  
  • Hydroxyzine  
  • Promethazine  
  • Triprolidine | These drugs cause many side effects in older adults, including confusion, drowsiness, blurred vision, difficulty urinating, dry mouth and constipation. Safer medications are available. | Avoid  
Use of diphenhydramine in special situations—such as for treating severe allergic reactions—may be appropriate. |
<table>
<thead>
<tr>
<th>Drugs and Categories of Drugs</th>
<th>Why these drugs may be inappropriate for older adults</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antiparkinsonian drugs prescribed for Parkinson’s disease and other health problems:</td>
<td>There are other medications that are usually more effective for Parkinson’s disease and related disorders than these. The drugs should not be used for other conditions, like treating side effects of other medications (for example the movement side effects of antipsychotic medications).</td>
<td>Avoid</td>
</tr>
<tr>
<td>• Benztropine (oral)</td>
<td></td>
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<tr>
<td>• Trihexyphenidyl</td>
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<tr>
<td>Antispasmodic medications prescribed to relieve cramps or spasms:</td>
<td>It’s is not clear whether these drugs are effective, but they have side effects.</td>
<td>Avoid except if used in short-term “comfort care.”</td>
</tr>
<tr>
<td>• Belladonna alkaloids</td>
<td></td>
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<tr>
<td>• Clidinium-chlordiazepoxide</td>
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<tr>
<td>• Dicyclomine</td>
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<td>• Hyoscyamine</td>
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<td>• Propantheline</td>
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<td>• Scopolamine</td>
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</tbody>
</table>
## Drugs affecting the brain and spinal cord

<table>
<thead>
<tr>
<th>Antidepressants, alone or in combination:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amitriptyline</td>
</tr>
<tr>
<td>Amoxapine</td>
</tr>
<tr>
<td>Clomipramine</td>
</tr>
<tr>
<td>Desipramine</td>
</tr>
<tr>
<td>Doxepin &gt;6 mg/d</td>
</tr>
<tr>
<td>Imipramine</td>
</tr>
<tr>
<td>Nortriptyline</td>
</tr>
<tr>
<td>Paroxetine</td>
</tr>
<tr>
<td>Protriptyline</td>
</tr>
</tbody>
</table>

Potential side effects include:
- confusion, drowsiness, blurred vision, difficulty urinating, dry mouth and constipation in older adults. They can also cause a drop in blood pressure and dizziness when you stand up. Safer medications are available.

| Avoid |

| All antipsychotic drugs |

These drugs may increase risks of confusion, sleepiness, blurred vision, difficulty urinating, dry mouth, constipation, stroke, and death in people with dementia.

Avoid using these drugs to treat behavioral problems in older people with memory disorders unless non-drug options haven’t worked and the patient is a threat to himself or herself or others.

| Avoid |

| Thioridazine |
| Mesoridazine |

These drugs may cause confusion, sleepiness, blurred vision, difficulty urinating, dry mouth and constipation. They may also increase risks of dangerous changes in heartbeat.

<p>| Avoid |</p>
<table>
<thead>
<tr>
<th>Barbiturates</th>
<th>These medications can be addictive. Over time, they get less effective in helping older adults sleep. They are more likely to cause overdoses at lower doses than alternative drugs.</th>
<th>Avoid</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Amobarbital</td>
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<tr>
<td>• Butabarbital</td>
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<tr>
<td>• Butalbital</td>
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<tr>
<td>• Mephobarbital</td>
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<tr>
<td>• Pentobarbital</td>
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<tr>
<td>• Phenobarbital</td>
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<tr>
<td>• Secobarbital</td>
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<tr>
<td>Benzodiazepines</td>
<td>Older adults are especially sensitive to these medications. These drugs may increase risks of mental decline, delirium, falls, fractures, and car accidents in older adults.</td>
<td>Avoid benzodiazepines (all types) when treating insomnia, agitation, or delirium (serious confusion that may have lasting effects).</td>
</tr>
<tr>
<td>Short- and intermediate-acting:</td>
<td></td>
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<tr>
<td>• Alprazolam</td>
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<td>• Estazolam</td>
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<td>• Lorazepam</td>
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<tr>
<td>• Oxazepam</td>
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<tr>
<td>• Temazepam</td>
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<tr>
<td>• Triazolam</td>
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<tr>
<td>Long-acting:</td>
<td>Despite these risks, they may be appropriate, in certain cases, for treating seizures, certain sleep disorders, anxiety disorders, withdrawal from benzodiazepine drugs and alcohol, and end-of-life care.</td>
<td></td>
</tr>
<tr>
<td>• Chlorzepate</td>
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<tr>
<td>• Clordiazepoxide</td>
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<tr>
<td>• Clordiazepoxide-amitriptyline</td>
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<tr>
<td>• Clidinium-chlordiazepoxide</td>
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<td></td>
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<tr>
<td>• Clonazepam</td>
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<tr>
<td>• Diazepam</td>
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<tr>
<td>• Flurazepam</td>
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<tr>
<td>• Quazepam</td>
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</tr>
<tr>
<td>Chloral hydrate</td>
<td>Not effective long-term, with high risk of overdose.</td>
<td>Avoid</td>
</tr>
<tr>
<td>Meprobamate</td>
<td>This medication makes older adults sleepy and can be addictive.</td>
<td>Avoid</td>
</tr>
<tr>
<td>Nonbenzodiazepine hypnotics</td>
<td>These medications may not significantly improve sleep and can cause many serious side effects, including confusion, falls, and bone fractures.</td>
<td>Avoid ongoing use of these drugs (over 90 days).</td>
</tr>
<tr>
<td>Pain Medications</td>
<td>Details</td>
<td>Advice</td>
</tr>
<tr>
<td>-------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Meperidine</td>
<td>This is not a very effective pain reliever and may cause seizures. Safer medications are available.</td>
<td>Avoid</td>
</tr>
<tr>
<td>Non–COX-selective Non-Steroidal Anti-inflammatory Drugs (NSAIDs), oral</td>
<td>These medications increase the chance of stomach and intestinal bleeding in adults 75 or older, and adults 65 and older taking certain other medications (like prednisone, warfarin, and clopidogrel) and medicines to prevent stroke.</td>
<td>Do not use these medications regularly unless there are no other effective alternatives and they are prescribed along with a proton-pump inhibitor or misoprostol.</td>
</tr>
<tr>
<td>Aspirin at doses higher than 325 milligrams per day</td>
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<tr>
<td>Diclofenac</td>
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<tr>
<td>Diflunisal</td>
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<tr>
<td>Etodolac</td>
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<tr>
<td>Fenoprofen</td>
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<td>Ibuprofen</td>
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<td>Ketoprofen</td>
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<tr>
<td>Meclofenamate</td>
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<tr>
<td>Mefenamic acid</td>
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<tr>
<td>Meloxicam</td>
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<td>Nabumetone</td>
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<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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<tr>
<td>Tolmetin</td>
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</tr>
<tr>
<td>Indomethacin</td>
<td>These drugs are NSAIDs that are even more likely to increase the chance of stomach and intestinal bleeding and ulcers or to cause other harmful effects.</td>
<td>Avoid</td>
</tr>
<tr>
<td>Ketorolac</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pentazocine</td>
<td>This pain reliever can cause confusion, hallucinations and other side effects. Safer medications are available.</td>
<td>Avoid</td>
</tr>
<tr>
<td>Methocarbamol</td>
<td>Most muscle relaxants have questionable effectiveness and can cause side effects such as sleepiness and increased risks of bone</td>
<td>Avoid</td>
</tr>
<tr>
<td>Orphendarine</td>
<td></td>
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<tr>
<td>Skeletal muscle relaxants</td>
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<tr>
<td>Carisoprodol</td>
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<tr>
<td>Chlorzoxazone</td>
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<tr>
<td>Cyclobenzaprine</td>
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<tr>
<td>Metaxalone</td>
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<tr>
<td>Medications for gastrointestinal problems</td>
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<td>----------------------------------------</td>
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</tr>
<tr>
<td>Metoclopramide</td>
<td>This medication may cause shakiness, sleepiness, and uncontrollable abnormal body movements. Frail older adults may be even more likely to get these effects.</td>
<td>Avoid, except for gastroparesis, a condition that reduces the ability of the stomach to empty its contents.</td>
</tr>
<tr>
<td>Mineral oil, taken by mouth</td>
<td>When swallowed, mineral oil may be accidentally inhaled and, as a result, can cause pneumonia. Safer medications are available.</td>
<td>Avoid</td>
</tr>
<tr>
<td>Trimethobenzamide</td>
<td>Not very effective for treating vomiting. This medication can cause side effects such as shakiness, sleepiness, and abnormal body movements.</td>
<td>Avoid</td>
</tr>
<tr>
<td>Disease or Syndrome</td>
<td>Drug(s)</td>
<td>Rationale</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Syncope or fainting</td>
<td>Acetylcholinesterase inhibitors • Donepezil • Galantamine • Rivastigmine • Peripheral alpha blockers • Doxazosin • Prazosin • Terazosin • Tertiary Tricyclic Antidepressants (TCAs): Amitriptyline, chlordiazepoxide-amitriptyline, clomipramine, doxepin, imipramine, perphenazine-amitriptyline, trimipramine Chlorpromazine, thioridazine, and olanzapine</td>
<td>These drugs increase the chance of dizziness, fainting, and falling, and may cause a slowed heartbeat.</td>
</tr>
<tr>
<td>Chronic seizures or epilepsy</td>
<td>Bupropion Chlorpromazine Clozapine Maprotiline Olanzapine Thioridazine Thiothixene Tramadol</td>
<td>These medications may increase the frequency of seizures in some older adults. But they may be acceptable in older patients with well-controlled seizures and for whom other drugs have not been effective.</td>
</tr>
<tr>
<td>Disease or Syndrome</td>
<td>Drug(s)</td>
<td>Rationale</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Delirium                                        | All Tricyclic Antidepressants (TCAs)  
All Anticholinergic drugs  
Benzodiazepines  
Chlorpromazine  
Corticosteroids  
H₂-receptor antagonist  
Meperidine  
Sedative hypnotics  
Thioridazine                                                                 | These medications can cause or worsen delirium in older people. Avoid these drugs in older adults with or at high risk of delirium.          | Avoid                |
| Dementia and cognitive/mental impairment        | Anticholinergic drugs  
Benzodiazepines  
H₂-receptor antagonists  
Zolpidem  
Antipsychotics—used regularly or as needed                                                                 | Avoid these drugs in adults with cognitive or “thinking” problems because these medications may make this worse.  
Antipsychotic drugs should not be prescribed for behavioral problems related to dementia unless non-drug or safer drug options are not working and a patient is a threat to himself or others. Antipsychotic drugs may increase the chance of stroke and death in people with dementia. | Avoid                |
| A history of falls or fractures                 | Anticonvulsants  
Antipsychotics  
Benzodiazepines  
Nonbenzodiazepine hypnotics  
• Eszopiclone  
• Zaleplon  
• Zolpidem  
Tricyclic Antidepressants (TCAs) and Selective Serotonin Uptake Inhibitors (SSRIs) | These drugs can cause fainting and falls, and make it hard to coordinate movements.                                                                                                                   | Avoid unless safer medications are not available. Avoid anticonvulsant drugs in someone with a history of falls/fractures unless it is for seizures. |
Anticholinergic Side Effects

- Dizziness
- Blurry Vision
- Drowsiness
- Hallucinations
- Memory impairment
- Delirium
- Confusion
- Clumsiness and slurred speech
- Dry mouth

- Blind as a bat (blurred vision, mydriasis)
- Mad as a hatter (hallucinations, psychosis, delirium, memory loss, coma)
- Red as a beet (flushing)
- Hot as heat (fever, hyperthermia)
- Dry as a bone (dry mouth, dry eyes)
- The bowel and bladder lose their tone (constipation, urinary retention, ileus)
- And the heart runs alone (tachycardia, hypertension)
Women using PIM at baseline had poor performance on cognitive tests
- Decreased memory function
- Decreased fluency
PIM use associated with 1 or more new ADL impairments
Followed up with 1429 community dwelling women over 5 years
- Mean age: 83.2±3.3 years old
Beers List medications:
- 76% anticholinergics
- 25% antispasmodics
- 11% sedative/hypnotics
- 8% benzodiazepines
- 4.3% CNS stimulants
- 2.5% muscle relaxants
- 2.3% barbiturates

<table>
<thead>
<tr>
<th>Beers List Criteria Classes</th>
<th>Most Common Meds (90% of reported PIMs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 76% anticholinergics</td>
<td>• Diphenhydramine (Benadryl) 21%</td>
</tr>
<tr>
<td>• 25% antispasmodics</td>
<td>• Oxybutynin (Ditropan) 13.7%</td>
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<tr>
<td>• 11% sedative/hypnotics</td>
<td>• Meclizine 10%</td>
</tr>
<tr>
<td>• 8% benzodiazepines</td>
<td>• Paroxetine (Paxil) 7.6%</td>
</tr>
<tr>
<td>• 4.3% CNS stimulants</td>
<td>• Lorazepam (Ativan) 7.1%</td>
</tr>
<tr>
<td>• 2.5% muscle relaxants</td>
<td>• Codeine 7.1%</td>
</tr>
<tr>
<td>• 2.3% barbiturates</td>
<td>• Amitriptyline 6.3%</td>
</tr>
<tr>
<td></td>
<td>• Tolteridone (Detrol) 5.8%</td>
</tr>
<tr>
<td></td>
<td>• Temazepam (Restoril) 5.3%</td>
</tr>
<tr>
<td></td>
<td>• Chlorpheniramine (Chlor-trimeton) 5.1%</td>
</tr>
</tbody>
</table>

And Hudson and I have a question for you?
Peds specialist?????
Case

• OFH is a 75yo male who has a stroke and he is referred to your service by his physician. OFH claims it is difficult for him to swallow his food.

• Past medical history significant for
  • metastatic colorectal cancer
  • 20 pound weight loss over the last month
  • Decreased appetite
Dysphagia in a 62 yr old female patient

Medical History includes:
- Diabetes
- Hypertension
- Cough

Medications include:
- Lisinopril 10mg daily for hypertension
- Tessalon Perles 200mg three times daily as needed for cough
CASES

- Tardive Dyskinesia in a 12 yr old

- Paradoxical Delirium in a 74 yr old post op patient