Safe Medication Use in the Older Adult

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Objectives

- Describe the principles of medication use in the elderly
- Identify potentially inappropriate medications for older adults
- Appropriately prescribe medication for older adults
Introduction

- Elderly comprise 13% of population
- Use over 30% of all prescription medications
- 90% of age ≥ 65 take at least one medication
- Use 5.8 Rx drugs concurrently with 3.2 OTC drugs
- Cost of medications: > $25.5 billion/year


What are Some Concerns with Med Use in Older Adults?

- Compliance/Adherence
  - Overuse
  - Underuse
- Polypharmacy
- Changes in aging
  - Drugs affect older adults differently
- Unclear medication regimen
  - Thorough med history at every visit
- Inappropriate diagnoses/ignoring ADRs
  - Attributing adverse effects to normal “aging” or a new illness
  - Underreporting of symptoms
  - Atypical symptoms
- Treatment of sx vs. treatment of disease
Compliance/Adherence

- Reasons for noncompliance
  - Lack of understanding
  - Barriers to communications
  - Complex regimen
  - Differing doses
  - Inconvenient scheduling
  - Lack of perceived need
  - Adverse events
  - Cost
  - Social isolation

Compliance/Adherence

- Discrepancies between medical record and actual medication use
  - 76% had discrepancies
  - 51% taking medications not recorded in chart
  - 29% not taking a recorded medication
  - 20% taking different dosage than recorded

Polypharmacy

- More chronic medical conditions = more medications
- Patient and prescriber’s need to “do something” even for common ailments with no cure
- Doctor shopping—often for the same problem
  - Do not reveal all information at each visit
- Meds prescribed to treat side effects of other meds!
- “Save” or borrow medications; self-medicate

Pharmacokinetics

- Pharmacokinetics
  - How the body affects the drug
    - Management of the drug by the body
    - Absorption, distribution, metabolism, excretion
- NOTE: These changes are not universal. We all age differently. Use as general guidelines.
Pharmacokinetic Changes

Absorption

- Changes
  - Decreased surface area and blood flow to GI
  - Decreased GI motility
  - Increased pH

- Result
  - Essentially unchanged
    - May have slightly decreased absorption-little effect
  - Drugs affected: ketoconazole, iron supplements (those that require an acidic environment)

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Pharmacokinetic Changes

Distribution

- Protein binding
  - Decreased albumin with age
    - Binds acidic drugs
    - Institutionalized, malnourished, and sick elderly
    - Results: need lower dose of acidic protein bound drugs
  - Increased $\alpha_1$-acid glycoprotein & lipoproteins
    - Increases with inflammation, stress, injury-binds basic drugs
    - Arthritis, institutionalized
    - Results: need higher dose of basic protein bound drugs
Pharmacokinetic Changes
Distribution

**Common Drugs Affected by Albumin**
- Digoxin
- Theophylline
- Phenytoin
- Warfarin
- Diazepam

**Common Drugs Affected by α₁-Acid Glycoprotein/Lipoproteins**
- Propranolol
- Quinidine
- Lidocaine

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**Pharmacokinetic Changes**

**Distribution**

- **Volume of Distribution**
  - Less total body water
    - Age 20-80, decrease 15%
    - Results: need a lower dose for hydrophilic drugs
      - Lower Vd can result in increased serum concentration
  - Higher fat content
    - Men from 18-36%; Women from 33-45%
    - Results: need a lower dose for lipophilic drugs
      - Do not use or use cautiously, especially CNS drugs
  - Lower lean muscle mass (decreased muscle)
    - Digoxin binds to muscle; therefore, conc increases as a result of increased Vd = dig toxicity at doses lower than expected
Pharmacokinetic Changes
Distribution

<table>
<thead>
<tr>
<th>Hydrophilic Drugs</th>
<th>Lipophilic Drugs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lithium</td>
<td>Phenothiazines</td>
</tr>
<tr>
<td>Aminoglycosides</td>
<td>Phenytoin</td>
</tr>
<tr>
<td>Ethanol</td>
<td>Diazepam</td>
</tr>
<tr>
<td></td>
<td>Barbiturates</td>
</tr>
<tr>
<td></td>
<td>Propranolol</td>
</tr>
</tbody>
</table>

Pharmacokinetic Changes
Metabolism

- Reduced hepatic blood flow
  - Some drugs’ rate of metabolism is dependent upon rate of hepatic blood flow
  - Decrease hepatic flow → Reduced amount of drug that is extracted by the liver for metabolism during first pass → Increased bioavailability of that drug
- Drugs affected: calcium channel blockers, beta blockers, narcotics, nitrates, tricyclic antidepressants, hydralazine, labetalol


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Pharmacokinetic Changes

Metabolism

- Reduced hepatic mass and number of functioning hepatocytes
- Phase I and II metabolism performed by cyt P-450 system
  - Decline in Phase I (oxidative) metabolism in elderly
  - Phase II unaffected by aging
  - Major drugs affected: diazepam, alprazolam, chlordiazepoxide, amitriptyline
  - **Benaodiazepine Pearl: Use L.O.T.**
    - Lorazepam, oxazepam, temazepam

Excretion/Elimination

- Renal function generally decreases with age
- CrCl decreases ~ 10%/decade after age 40 in 2/3 persons
- **Pearl: Is serum creatinine a good indicator of renal function in the elderly?**
  - NO!
  - Scr is a product of muscle breakdown
    - Decreased muscle mass in aged \(\rightarrow\) reduced production of Scr
    - Scr \(\rightarrow\) could produce normal Scr in person with reduced renal function
  - CrCl is better indicator of renal function
Pharmacokinetic Changes
Excretion/Elimination

<table>
<thead>
<tr>
<th>Common Renally-eliminated Drugs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allopurinol</td>
</tr>
<tr>
<td>Ranitidine, famotidine, nizatidine</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
</tr>
<tr>
<td>Meperidine</td>
</tr>
<tr>
<td>Magnesium</td>
</tr>
<tr>
<td>Metformin</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Aminoglycosides</td>
</tr>
<tr>
<td>Most ACE inhibitors (except fosinopril)</td>
</tr>
<tr>
<td>Digoxin</td>
</tr>
<tr>
<td>Lithium</td>
</tr>
<tr>
<td>Diuretics</td>
</tr>
</tbody>
</table>

Potentially Inappropriate Medications: Beers Criteria

Potentially Inappropriate Medications: Beers Criteria

- Medications or classes that should generally be avoided in persons 65 years or older because they are either ineffective or they pose unnecessarily high risks for older persons and a safer alternative is available
  - 48 medications or classes to avoid
- Medications that should not be used in older persons known to have specific medical conditions
  - 20 diseases or conditions and medications to avoid

### Potentially Inappropriate Medications Considering Dx: Beers Criteria

- COPD: beta-blockers, sedative/hypnotics
- Ulcers: NSAIDs
- Seizures: metoclopramide, some antipsychotics
- Bladder outflow obstruction: anticholinergics & antihistamines
- Arrhythmias: tricyclic antidepressants
- Insomnia: decongestants, theophylline, SSRIs
- Hypertension: pseudoephedrine
- Cognitive impairment: anticholinergics
- Chronic constipation: calcium channel blockers, anticholinergics, TCA


### Potentially Inappropriate Medications: Zhan Criteria

Potentially Inappropriate Medications: Zhan Criteria

- Reevaluated Beers criteria with expert panel to evaluate in community-dwelling elderly
- Always avoid: 11 medications
  - Barbiturates, flurazepam, meperidine, etc.
- Rarely appropriate: 8 medications
  - Diazepam, propoxyphene, cyclobenzaprine, etc.
- Some indications: 14 medications
  - Amitriptyline, diphenhydramine, doxepin, etc.

How Well Are We Doing?

- 765,423 patients 65 and older in a PBM were reviewed
- 21% of patients had 1 or more prescriptions filled for drugs of concern
- 51% of those claims were for drugs with the potential for severe adverse effects
  - 23% of claims were for amitriptyline and doxepin
- 15% of patients filled prescriptions for 2 drugs of concern
  - 4% filled for 3 or more within the same year

How Well Are We Doing?

<table>
<thead>
<tr>
<th>Setting</th>
<th>&gt;1 Inappropriate</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nursing facility</td>
<td>40.3%</td>
<td>Beers, 1992</td>
</tr>
<tr>
<td>Community</td>
<td>28.7%</td>
<td>Willcox, 1994</td>
</tr>
<tr>
<td>Homebound</td>
<td>39.7%</td>
<td>Golden, 1999</td>
</tr>
<tr>
<td>Community</td>
<td>25.0%</td>
<td>Zhan, 2001</td>
</tr>
<tr>
<td>ALF</td>
<td>16.0%</td>
<td>Sloane, 2002</td>
</tr>
<tr>
<td>Residential Care</td>
<td>22.0%</td>
<td>Gray, 2003</td>
</tr>
<tr>
<td>Community</td>
<td>21.2%</td>
<td>Curtis, 2004</td>
</tr>
</tbody>
</table>

Outcomes of Inappropriate Prescribing

- In nursing home residents
  - 30% higher risk of hospitalization
  - 21% higher risk of death
  - Sample 3,372 residents with > 3 consecutive months of stay

Outcomes of Inappropriate Prescribing

- 1,117 medical records reviewed in 15 nursing homes with high risk of polypharmacy
- Adverse outcomes: hospitalization, ED visit or death
  - Any inappropriate prescription increased likelihood of an adverse outcome
  - One of the first studies to prove that inappropriate medications (as defined by Beers) is associated with adverse outcomes


Adverse Drug Reactions

- Unintended, unwanted, harmful or unexpected effect of a drug
- 28% of hospitalizations in the elderly attributed to ADRs (17%) and non-adherence (11%)
- 10-35% of elderly outpatients experience ADRs
- May occur in as many as 44% of hospitalized elderly
- ADR risk doubles when drug use increases from 1 to 4 drugs; increases 14-fold in elders who use 7 drugs

Causes of ADRs

- Improper drug or dosage selection
- Non-adherence to drug regimen
- Altered pharmacokinetics
- Multiple medications
- Multiple providers

ADR Risk Factors

- Advanced age (> 85)
- Female
- Lower SES
- Lives alone
- Lower body weight
- Hx prior drug reactions
- Regular use of alcohol
- Prior ADR
- Recent hospitalization
- Dementia
- Hepatic or renal insufficiency (CrCl<50 ml/min)
- Multiple prescribers
- Long duration of use
- Polypharmacy
- Multiple chronic diseases

ADR Pearl

Any symptom in an older adult should be considered a drug side effect until proven otherwise!

- Fall
- GI distress
- Incontinence
- Constipation
- Depression
- Anxiety
- Confusion
- Insomnia

Common ADRs in Elderly

- Falls
  - Sedative/hypnotics, anticonvulsants, antihypertensives, antipsychotics, antineoplastics, hypoglycemics
- GI Distress
  - Aspirin, NSAIDs, iron, theophylline, lipid-lowering agents, antibiotics
- Incontinence
  - Caffeine, diuretics, theophylline, alcohol, sedative/hypnotics
Common ADRs in the Elderly

- Constipation
  - Verapamil/diltiazem, antipsychotics, antidepressants, narcotics, diuretics, antacids (Al/Ca), anticholinergics
- Confusion
  - Any CNS agent, anti-Parkinson’s agents, digoxin, metoclopramide, beta-blockers
- Depression
  - Beta-blockers (propranolol), sedative/hypnotics, hormones, NSAIDs, digoxin, metoclopramide
- Anxiety/insomnia
  - Caffeine, theophylline, SSRIs, decongestants, steroids

Prescribing Cascade

Medications prescribed to treat side effects of other medications!!!

“As older patients move through time, often from physician to physician, they are at increasing risk of accumulating layer upon layer of drug therapy, as a reef accumulates layer upon layer of coral.”

Jerry Avorn, MD

Drug Interactions

- Drug-Drug - too many to list!
  - Common disease states associated with high risk of drug interactions: autoimmune, cardiovascular, gastrointestinal, infection, psychiatric d/o, respiratory, seizure d/o
  - 2 medications = 13% risk
  - 5 medications = 38% risk
  - > 7 medications = 82% risk
  - Preventable drug interactions account for about 1/3 of ADRs

http://www.scoup.net/M3Project/topten/

Pearls for Safe Medication Use

- Every drug must have clearly defined indication
- Patient education
- Records containing complete medication review, including OTCs and herbals
- Therapeutic endpoints and ADRs must be monitored
- Provide annual drug regimen review
Small Case Study 1

- MH is a 77 yo female residing in a NH
  - Weight = 112 lbs.
  - Scr = 1.0
- Medications
  - Ranitidine 150 mg bid
  - Atenolol 50 mg qam
  - Diazepam 5 mg qhs
  - Acetaminophen 1g q6h prn pain
  - MOM 15 ml qid prn

Small Case Study 2

- CK is a 82 yo male entering your primary care clinic for an initial visit to establish care. Your interview reveals the following:
  - Tylenol PM qhs
  - Diazepam 2.5 mg qhs
  - Combivent 2-4 puffs 4 times daily
  - Doxazosin 4 mg qhs
- Dx: COPD, insomnia, BPH, hypertension
- What meds would you deem potentially inappropriate and why?
Small Case Study 3

- PT is an 81 yo female. She enters the clinic pharmacy today after a visit to her primary care provider. She requests some OTC products.
  - Med profile
    - Triamterene/HCTZ 75/50 mg qd
    - Metoprolol 50 mg bid
    - Glyburide 10 mg bid
    - Insulin 70/30 25 U bid
    - Celecoxib 200 mg qd
    - Propoxyphene-N-100 mg qid
  - OTC list: hard candies, glucose tablets, calcium, Depends, glucosamine, APAP
- What questions should be asked? What are some potential problems?