Pharmacology for the Geriatric Surgical Patient

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KEYWORDS

• Geriatrics • Surgery • Pharmacology • Adverse drug reactions

KEY POINTS

- Physical changes with age alter how medications act and are metabolized by the body.
- The elderly are at increased risk of experiencing an adverse effect of medications, especially during the postoperative period when additional medications are added to their regimen.
- All medications used in the elderly should be dose adjusted to account for altered pharmacokinetics and should be titrated to the lowest effective dose for the shortest appropriate duration.

INTRODUCTION

The elderly make up a significant proportion of the population in the United States. In 2011, adults older than 65 years made up 13.3% of the United States population or approximately 41.1 million, and those over the age of 85 comprised about 5.7 million people. The elderly are also living healthier lives, with 44% of noninstitutionalized elderly describing their health as very good or excellent (http://www.aoa.gov/Aging_Statistics/. Accessed 3/13/2014.)

Unfortunately, the elderly are at increased risk of experiencing an adverse drug reaction (ADR). ADRs may account for up to 24% of hospitalizations in the elderly. Approximately 1 in 6 elderly patients will experience an ADR during admission to hospital.[1,2] ADRs in the elderly often present in an atypical manner and are nonspecific. A single ADR can increase a patient's length of stay in hospital by an average of 6.2 days.[3]

Many ADRs are preventable, as they are based on the known mechanism of action and/or predictable decreased clearance of the medication, withdrawal of a chronic

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medication, or a drug-drug interaction.[1] Awareness of common physiologic changes and common drug-drug interactions seen in the elderly may help prevent ADRs in geriatric surgical patients (**Box 1**).

CHANGES IN PHARMACOKINETICS AND PHARMACODYNAMICS

Aging is not a single process, so as individuals age their interindividual variability accumulates. This variation creates differences in response to physiologic stress. The ease with which elderly patients tolerate surgery is related to their specific aging process. In general, the elderly experience many physiologic changes that affect their ability to metabolize and use medications (**Tables 1** and **2**). The frail elderly require even more caution when dosing and using medications.

Absorption and Bioavailability

Saliva production and gastric acid secretion are thought to be reduced as a result of aging. Although this theoretically could cause less drug to be available for absorption because of changes in ionization, in clinical practice this change seems to have little effect on medications used in the geriatric patient. Alternatively, these changes may be more frequent in frail patients and do not apply to healthy older patients who lack comorbid conditions.[4]

Oral bioavailability is not only determined by the amount of drug present in the gastrointestinal (GI) tract but also whether the absorbed drug undergoes first-pass hepatic metabolism before systemic distribution. First-pass metabolism reduces the amount of drug reaching the systemic circulation, thus reducing bioavailability. This first-pass metabolism may be impaired by decreased blood flow to the liver or by decreased activity of hepatic enzymes, leading to a decreased amount of drug extracted.[5] In turn this may lead to higher serum concentrations of certain medications (eg, propranolol and labetalol).[4]

Distribution

Body composition changes over time. As the body ages, total body fat increases at the expense of lean body mass and total body water. These changes lead to a smaller volume of distribution and, consequently, higher drug concentration for hydrophilic medications such as digoxin, but larger volumes of distribution for lipophilic medications such as lidocaine, phenytoin, and benzodiazepines.[1,4,5] The distribution of these medications into the adipose tissue may lead to a delayed effect of the medication.

Box 1
Common drug classes associated with adverse drug reactions

- Antibiotics
- Digoxin
- Antihyperglycemic agents
- Anticoagulants/Antithrombotics
- Diuretics
- Nonsteroidal anti-inflammatory agents

Adapted from Petrovic M, van der Camme T, Onder G. Adverse drug reactions in older people: detection and prevention. Drugs Aging 2012;29:454.