American Academy of Otolaryngology—
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Geriatric Care Otolaryngology

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Chapter 8

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Geriatric Polypharmacy in Otolaryngology

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The term "polypharmacy" refers to "the administration of many drugs." In today's world, polypharmacy probably applies to drug use within most of the population. Considering over-the-counter pain relievers, sinus and cold remedies, vitamins, alternative medications, and "magic herbs," most people consume some form of medication on a daily basis. Because the vast majority of the population is seen by a physician at least once a year, it is easy to see how the number of medications taken either by prescription or otherwise can rapidly become a meaningful statistic, thus justifying the term polypharmacy.

Recent data demonstrate that the elderly (population aged 65 years or more) represent approximately 12 percent of the U.S. population. However, this same 12 percent of the population accounts for approximately 32 percent of annual prescriptions. The average elderly person uses two to six prescription drugs and one to more than three over-the-counter medications on a daily basis.[1]
Looking into the future, it should be noted that during the twentieth century the number of people in the United States less than 65 years of age tripled. During the same period, the number of people over 65 increased 11 times. Current population projection studies estimate that by the year 2050 the elderly population will have more than doubled. At the midpoint of the twenty-first century, one in five Americans will be considered elderly.[2]
When one considers that up to one-third of the patients seen by the average otolaryngologist practicing in the United States are aged 65 or older, it is readily understandable why it is necessary to have a good foundation in geriatric otolaryngologic polypharmacy.

Common Pathologies in Geriatric Otolaryngology

It is important to realize that many otolaryngologic disorders can be seen in almost any age group. However, age predicts to a varying degree the prevalence of disease in certain chronologic populations. It is with this in mind that the following list of geriatric otolaryngologic disorders is presented. The disorders presented below reflect the most common geriatric otolaryngologic manifestations.

Otologic

Hearing Loss

- Sensory
- Conductive

a. cerumen impaction
b. serous otitis
c. otosclerosis

• Mixed

Balance Disorders

• Benign Paroxysmal Positional Vertigo
• Labyrinthitis
• Meniere's
• Multiple Medications

Rhinologic

• Rhinitis
• Epistaxis
• Nasal Obstruction
• Olfactory Dysfunction
• Sinusitis

Oropharyngeal

• Dysphagia
• Aspiration
• Xerostomia
• Burning Mouth Syndrome
• Laryngopharyngeal Reflux

Laryngeal

• Voice Disturbance

Other

• Thyroid
• Head And Neck Cancer
• Cosmetic

Brief Description of Otolaryngologic Geriatric Disorders and Possible Treatments

The following description of the above disorders and their treatments is not meant to serve as a definitive reference for diagnosis and treatment of geriatric otolaryngologic disease. Rather it is simply a brief outline to serve as a foundation to better understand polypharmacy in the elderly otolaryngologic patient.

Otologic

Hearing loss is the most common otolaryngologic manifestation in the geriatric population.[3] Approximately 60 percent of the population in the United States, aged 65 and older, has at least a 25dB compromise in hearing. Hearing in this patient group may be divided into sensory, conductive, and mixed hearing loss. Sensory hearing loss, the most common type of hearing loss in the elderly patient, is almost universally treated with amplification or a hearing aid. Medications associated with this might include topical steroid creams in the event of sensitivity to hearing aid ear molds. Conductive hearing loss is typically caused by cerumen impaction or middle ear fluid. Cerumen impaction is the most common and most treatable cause of conductive hearing loss in the elderly. A recent study of 29 elderly patients in a skilled nursing facility demonstrated that 19 patients (65.5 percent) had at least one ear occluded by 50 percent or more with cerumen. Hearing improved in 80 percent of the ears after cerumen removal.[4] A variety of over-the-counter cerumenolytic agents are readily available to treat this problem.

Serous otitis is most commonly a result of eustachian tube dysfunction. A variety of possible causes include infection, allergy, and mechanical obstruction. Medications most often used in the treatment of these disorders include antibiotics, antihistamines, decongestants (oral and topical), nasal steroid sprays, and oral steroids. Otosclerosis is most commonly treated with surgery or amplification.

Balance disorders often result in seriously incapacitating injuries. It has been estimated that in a one-year period, 30-50 percent of people 65 and older fall at least once. That number increases to 50 percent after age 80.[5] In 1 percent of this age group, falls result in hip fractures. An overall 5 percent fracture rate is seen. Approximately half of the hip fractures never regain normal function. Balance disorders have many etiologies including cardiovascular disease, neurologic disease, multiple medications, and, of course, vestibular pathology. Vestibular disorders include benign paroxysmal positional vertigo (BPPV) and Meniere's. BPPV is treated with vestibular exercises, canalith repositioning, and numerous medications including meclizine and benzodiazepines for symptomatic relief. Meniere's may be treated with a low-salt diet, diuretics, and vestibular suppressants.

Rhinologic

Many forms of rhinitis have been described. Allergic rhinitis and nonallergic rhinitis have been treated with a combination of medications including antihistamines, decongestants, nasal steroid sprays, oral steroids, and nasal saline and nasal antihistamine sprays. Vasomotor rhinitis has been treated with ipratroprium, nasal steroid sprays, and antihistamine sprays. Epistaxis may be treated with moisturizing agents (saline nasal sprays), antibiotics, and lubricants. Many elderly people with nosebleeds are taking anticoagulant medication, which must be considered in the overall treatment plan. Nasal obstruction results from multiple causes and therefore has multiple treatments. Obstruction from trauma is most often addressed with surgical intervention. Allergic and vasomotor rhinitis may result in obstruction. Their treatments have been presented. Rhinitis medicamentosa (rebound rhinitis) is treated with discontinuation of the offending topical agent, application of a topical nasal steroid spray, and a short tapering dose of oral steroids.

Olfactory function has been shown to decline in people more than 60 years old.[6] More than 50 percent of people over age 80 have dysfunctions of smell.[7] Because the sense of smell is probably the least understood of all the senses, there are not a lot of treatment options. Treatment is according to underlying cause outlined above for obstructive and other inflammatory disorders. Sinusitis is relatively common in the aged population and frequently is overlooked because symptoms are often more subtle than in younger people. Treatment of sinusitis is typically accomplished with varying combinations of antibiotics, decongestants, mucolytics, hydration irrigations, and occasionally antihistamines.

Oropharyngeal

Dysphagia may occur in 10–30 percent of elderly patients.[8] The list of potential causes of dysphagia in the geriatric population is long. Systemic causes include musculoskeletal, connective tissue, autoimmune, cardiovascular, neurologic, and general disorders. Medications that can cause dysphagia include anticholinergics, antidepressants, antihypertensives, diuretics, and phenothiazines. Other possible etiologies of geriatric dysphagia relate to local disorders of the oropharynx, hypopharynx, and esophagus. Treatments of these disorders may include multiple medications, which in turn can cause further problems.

Aspiration and in particular silent aspiration in the elderly is a frequent cause of pneumonia. Pneumonia is treated with antibiotics, which may also contribute to polypharmacy in the elderly. Xerostomia is a common symptom in up to 20 percent of the elderly population. Again, the administration of multiple medications in itself is a common cause of this problem in the elderly. Other causes of xerostomia include diabetes, psychotropic drugs, and radiation therapy.
Burning mouth syndrome has not been definitively linked to any specific etiology. Varying degrees of treatment success have been realized employing symptomatic treatment with low dosages of tricyclic antidepressants, benzodiazepines, and anticonvulsants.[9] Laryngopharyngeal reflux is seen in all age groups but certainly is recognized in the elderly. It is treated primarily with diet, proton pump inhibitors, and H2 blockers.

Laryngeal

Vocal dysfunction is seen in approximately 12 percent of the geriatric population.[10] Speech therapy is the mainstay of treatment although other underlying causes such as essential tremor, Parkinson's disease, stroke, myasthenia gravis, and thyroid disease may introduce new medications.

Other

Thyroid disease is usually treated with synthroid or other similar medications. Head and neck cancer may involve numerous medications. A number of chemotherapeutic agents, including cisplatin, bleomycin, vincristine, vinblastine, and nitrogen mustard, may produce ototoxicity. Finally, let us not forget that with the appearance of aging comes the desire for the disappearance of aging. Botox, fillers, and a plethora of cosmetic antiaging drugs have found their way into the market in recent years. The geriatric population accounts for some of the most avid users of these drugs.

Correctly Medicating the Geriatric Population in a Polypharmacy World

Based on the presentation above of the more common geriatric otolaryngologic disorders and their suggested possible treatments, the otolaryngologist should be aware of the several medications that can be used for elderly patients, and of the possible problems that can be caused by the harmful interaction of some of these particular drugs. A partial list of medications available to the otolaryngologist is provided in table 1.

Table 1.
Partial List of Medications in the Otolaryngologist's Arsenal

Topical Steroid Creams	Antibiotics
Betamethasone	Amimnoglycosides
Mometasone	Neomycin
Fluocinonide	Tobramycin
Triamcinolone	Gentamycin
Fluocinolone	

Macrolides	Cephalosporins
Azithromycin	Cefazolin
Clarithromycin	Cephalexin
Erythromycin	Cefaclor
	Cefuroxime
	Cefprozil
	Cefoxitin

Penicillins	Quinolones
Amoxicillin	Levofloxacin
Amoxicillin/Clavulanate	Moxifloxacin
	Ciprofloxacin

Other Antimicrobials	Cerumenolytics
Clindamycin	Various OTC Preparations
Metronidazole	

Sedating	Decongestants
Hydroxyzine	Pseudoephedrine
Diphenhtdramine	Ephedrine
Cetirizine	Guaifenesin

Antihistamines	Nasal Sprays
Nonsedating	Steroids
Fexofenadine	Beclomethasone
Desloratadine	Fluticasone
Loratadine	Triamcinolone
	Mometasone
	Budesonide

Oral Steroids	**Other**
Prednisone	Oxymetazaline
Methylprednisolone	Azelastine
	Ipratropium

Diuretics	Anti-Vertiginous
Hydrochlorothiazide Dyazide	Meclizine Benzodiazepines
Gastrointestinal	**Chemotherapeutics**
Proton Pump Inhibitors Rabeprazole Esomeprazollansoprazole Omeprazole Pantoprazole **H2 Blockers** Nizatidine Cimetidine Famotidine Ranitidine	Cisplatin Bleomycin Vincristine Vinblastine Nitrogen Mustard
	Cosmetic Applications
	Botox Dermal Fillers

Potentially Problematic Drug Group Interactions

Although it is not within the scope of this essay to present all possible drug interactions, the more common drug group interactions are discussed below.

Aminoglycosides and Cephalosporins. Nephrotoxicity, or the quality or state of being toxic to kidney cells, may result from the combined use of aminoglycosides and cephalosporins.[11] The mechanism of action is unknown. Predisposing factors include older age, preexisting renal compromise, and large doses of either drug. The fact that elderly patients are considered to be at increased risk in

this group is a reflection of the large number of patients in this group who are taking multiple medications, have multiple medical disorders, and have preexisting renal impairment. Renal functions should be closely monitored in this group if alternative regimens are not possible.

Quinolones and Corticosteroids. The quinolone group of antibiotics is known to possibly cause arthropathy.[12] Corticosteroids increase the risk of tendon rupture and or tendonitis.[13] The exact mechanism of action has not been demonstrated. However, the geriatric population is known to be at increased risk for adverse effects from these drug interactions. These interactions are easily and often overlooked. Large numbers of geriatric patients already have arthritis and other arthropathies. Therefore this drug interaction can readily be mistakenly attributed to other ongoing disease or simply explained by the expectation of joint pain and pathology in older patients. The combined use of these medications is not unlikely to be seen in the geriatric patient population. It should be kept in mind that the interactions may be generated by topical nasal corticosteroids as well as oral IV and IM steroids. The prescribing practitioner is therefore urged to keep this interaction in mind and use this combination of drugs only when other combinations are not applicable.

Levofloxacin and QT Prolonging Agents. The QT interval is the time from electrocardiogram Q wave to the end of the T wave corresponding to electrical systole. The concurrent use of levofloxacin and drugs that prolong the QT interval may result in synergistic or additive effects on the

QT interval.[14] This may result in life-threatening cardiac arrhythmias, including torsades de pointes. The risk of QT prolongation increases with age. It can therefore again be seen that the elderly are particularly at risk. Because the incidence of cardiac arrhythmias tends to increase with age, it is again an easy mistake to overlook the drug interaction of these life-threatening conditions and ascribe arrhythmias to normal events of aging. It is important to keep this in mind when prescribing these drugs in the elderly.

Importance of Understanding Pharmacokinetics and Aging

It could be concluded that harmful drug interactions or effects are predictable by virtue of the known pharmacology of the drugs and that they are therefore avoidable. But in order to properly understand and effectively work with polypharmacy in the geriatric population, it is essential to establish a basic knowledge of pharmacokinetics and aging. Four physiologic events can give a firm foundation to achieving this goal. They are (1) absorption, (2) distribution, (3) metabolism, and (4) renal excretion.

Absorption in the elderly plays only a minor a role in prescribing patterns. Age-related gastrointestinal and skin changes surprisingly do not usually significantly alter absorption patterns with most medications. An error that should be avoided is to alter dosing based solely on the idea of decreasing absorption rates in the geriatric patient. Distribution of medications often changes with aging.

Aging usually results in a decrease in lean body mass and total body weight. This in turn results in an increase in the overall percentage of body fat. This is important to consider because of the increase in volume of distribution for lipophillic medications such as sedatives that penetrate the central nervous system.

Metabolism is variable in the elderly as it is in other age groups. Even though liver function tests do not demonstrate large changes with aging, there is a degree of general decline in metabolic capacity. This results from decreased liver mass and hepatic blood flow. This must be kept in mind when prescribing for the elderly and it is suggested that prescribing guidelines be checked regularly.

Renal excretion is a well-established parameter in prescribing methods. Age-related decrease in renal blood flow and glomerular filtration rate are well recognized. Regular precautions in this area are encouraged.

Necessity of Recognizing Inappropriate Medications for the Elderly

Although careful scrutiny should be employed when prescribing all medications to the geriatric population, it is also important for physicians to know that certain medications are potentially dangerous as stand-alones. In 1991, Mark Beers headed a group of investigators at the University of California, Los Angeles, in formulating a list of criteria for determining the appropriate use of medica-

tions in the elderly living in nursing homes. He updated the list in 1997.[15] The list includes 28 medications or classes of medications that were considered inappropriate for use in the elderly. Fourteen of the 28 medications were considered to have potentially severe adverse reactions when used in the geriatric population. This list was updated by Fick et al. in 2003.[16] Table 2 (below) lists the drugs presented by Fick et al. in their update.

Potentially Inappropriate Medications for the Elderly According to the Revised Beers Criteria

For detailed information on herbs, supplements, or generic or brand name medications, reference MedlinePlus (http://www.nlm.nih.gov/medlineplus/druginformation.html), a service of the U.S. National Library of Medicine and the National Institutes of Health.

CLICKABLE

A

- alprazolam (Xanax)
- amiodarone (Cordarone)
- amitriptyline (Elavil)
- amphetamines
- anorexic agents

B

- barbiturates
- belladonna alkaloids (Donnatal)
- bisacodyl (Dulcolax)

C

- carisoprodol (Soma)
- cascara sagrada
- chlordiazepoxide (Librium, Mitran)
- chlordiazepoxide-amitriptyline (Limbitrol)
- chlorpheniramine (Chlor-Trimeton)
- chlorpropamide (Diabinese)
- chlorzoxazone (Paraflex)
- cimetidine (Tagamet)
- clidinium-chlordiazepoxide (Librax)
- clonidine (Catapres)
- clorazepate (Tranxene)
- cyclandelate (Cyclospasmol)
- cyclobenzaprine (Flexeril)
- cyproheptadine (Periactin)

D

- dessicated thyroid
- dexchlorpheniramine (Polaramine)
- diazepam (Valium)
- dicyclomine (Bentyl)
- digoxin (Lanoxin)
- diphenhydramine (Benadryl)
- dipyridamole (Persantine)
- disopyramide (Norpace, Norpace CR)
- doxazosin (Cardura)
- doxepin (Sinequan)

E

- ergot mesyloids (Hydergine)
- estrogens
- ethacrynic acid (Edecrin)

F

- ferrous sulfate (iron)
- fluoxetine (Prozac)
- flurazepam (Dalmane)

G

- guanadrel (Hylorel)
- guanethidine (Ismelin)

H

- halazepam (Paxipam)
- hydroxyzine (Vistaril, Atarax)
- hyoscyamine (Levsin, Levsinex)
- hioridazine (Mellaril)

I

- indomethacin (Indocin, Indocin SR)
- isoxsuprine (Vasodilan)

K

- ketorolac (Toradol)

L

- lorazepam (Ativan)

M

- meprobamate (Miltown, Equanil)
- mesoridazine (Serintil)
- metaxalone (Skelaxin)
- methocarbamol (Robaxin)
- methyldopa (Aldomet)
- methyldopa-hydrochlorothiazide (Aldoril)
- methyltestosterone (Android, Virilon, Testrad)
- mineral oil

N

- naproxen (Naprosyn, Avaprox, Aleve)
- neoloid
- nifedipine (Procardia, Adalat)
- nitrofurantoin (Microdantin)

O

- orphenadrine (Norflex)
- oxaprozin (Daypro)
- oxazepam (Serax)
- oxybutynin (Ditropan)

P

- pentazocine (Talwin)
- perphenazine-amitriptyline (Triavil)
- piroxicam (Feldene)
- promethazine (Phenergan)
- propantheline (Pro-Banthine)
- propoxyphene (Darvon) and combination products

Q

- quazepam (Doral)

R

- reserpine (Serpalan, Serpasil)

T

- temazepam (Restoril)
- thioridazine (Mellaril)
- ticlopidine (Ticlid)
- triazolam (Halcion)
- trimethobenzamide (Tigan)
- tripelennamine

In a study completed at Duke University, it was determined that, in a one-year period, 20 percent of elderly citizens whose benefits were processed by a large pharmaceutical benefits manager filled a prescription for at least one medication classified in the Beers list as a "drug of concern."[17] Five drugs from this list have particular relevance in the otolaryngologic geriatric patient pool. They are alprazolam, amitriptyline, diazepam, diphenhydramine, and propoxyphene.

Alprazolam and diazepam may result in side effects including drowsiness, light-headedness, fatigue, dizziness, irritability, and confusion. These are all symptoms that can mistakenly be attributable to "old age." Therefore treatment results can be easily misinterpreted and can result in dangerous consequences. Amitriptyline is a frequently employed mood elevator. Like alprazolam and diazepam it too may result in confusing and misleading symptoms, especially in the elderly. These symptoms include slow or difficult speech, dizziness or faintness, crushing chest pain, seizures, and visual and auditory hallucinations. Diphenhydramine should be generally avoided in the elderly. It commonly results in dry mouth, confusion, urinary retention, and constipation. It is found frequently in over-the-counter preparations for sleep, upper respiratory infections, and allergy. Propoxyphene should probably not be used at all in older adults. Elderly people are especially sensitive to the effects of narcotic analgesics. This may increase the chance of side effects, especially breathing problems, during treatment.

The Problem of Adverse Drug Reactions and the Elderly in a Polypharmacy World

Polypharmacy in today's world is becoming the standard as opposed to the exception. This is seen much more in the elderly population than in any other group of individuals. A number of facts contribute to this statistic. It is well accepted that with increased age comes increased potential for disease. In addition, the complexity and severity of disease rises with age. The number of diseases seen in the geriatric population on an individual basis is also recognized to be overall much greater than in the general population. Finally it can be readily seen that all of the above facts are amplified by recognition that the elderly population is living longer with the progression of medical knowledge and skills. Based on all of the above it is easy to understand the reasons for the marked increase in drug use in the elderly.[18]

The potential for serious problems arises with the increasing number of drugs used in any given individual patient. These problems are referred to as adverse drug reactions (ADRs). A linear relationship has been well established between the number of drugs taken and the increased potential for ADRs.[19] It is alarming to realize that at least 80 percent of ADRs resulting in hospital admissions are classified as type A (dose-related) in nature.[20] ADRs are seen much more often in the elderly patient for multiple reasons. With increasing age comes decreasing natural defense mechanisms leading to greater susceptibility to ADRs. In addition, individual drug toxicities are sometimes magnified when combined with other medications. Multiple medications used in combination in a single patient can produce ADRs not seen by the use of these same medications used individually.

Adverse drug reactions and adverse drug interactions are a common cause for elderly patients to be admitted to the hospital.[21] While in the hospital, adverse drug reactions are seen more commonly in geriatric patients and may contribute to morbidity and death.[22] Lazarou et al. demonstrated that even after eliminating errors in noncompliance, drug abuse, drug administration, overdose, and therapeutic failures, the overall incidence of serious ADRs of the general hospitalized patient population in the United States was 6.7 percent.[23] It was further concluded that the incidence of fatal ADRs was 0.32 percent in patients from 39 prospective studies included in these authors' meta-analysis. ADRs are therefore likely to be between the fourth and sixth most common cause of death in the United States. ADRs in Europe are more prevalent than in the United States. Wiffen et al. demonstrated the incidence of ADRs in Europe to be two times those in the United States before 1985. In studies carried out more recently, the ADR rates for both Europe and the United States in the geriatric environment were 20 percent greater than in the pre-1985 studies.[24]

In sum, polypharmacy is a growing concern throughout the world, especially as it concerns the elderly. Prevention of complications of polypharmacy in the geriatric population may be best accomplished by recognition and compliance with prescribing guidelines specifically outlined

for older patients. Failure to recognize the differences in older adults has disastrous potential for error. Older adults should only be prescribed medications that are absolutely necessary. Medication lists in the elderly are frequently a compilation of multiple physicians. These lists should be reviewed often and unnecessary medications should be discontinued. It is extremely important, when diagnosing and treating the elderly, to recognize that drug reactions may result in effects that mimic the conventional concept of "growing old." These effects include but are not limited to loss of balance, drowsiness, incontinence, dizziness, falls, confusion, depression, nervousness, fatigue, malaise, and insomnia. Adverse drug reactions such as dizziness from antihypertensives must not be treated with other drugs such as meclizine. Prescribing errors may also be minimized by prescribing medications that are taken only once a day and limiting the use of PRN or as-needed medications.

Quiz

1. People over age 65 living in the United States comprise approximately 32 percent of the population. They account for what percentage of the annual prescriptions written in the United States?
   a) 18%
   b) 32%
   c) 43%
   d) 52%

2. Dysphagia occurs in up to 30 percent of elderly patients. It is important to realize that this may be induced by medications including:
   a) Anticholinergics
   b) Antidepressants
   c) Antihypertensives/diuretics
   d) Phenothiazines
   e) All of the above

3. Arthritis and other arthropathies are commonly seen in the geriatric population. It is therefore a very easy error to overlook the iatrogenic etiology of these diseases by prescribing which of the following drug combinations?
   a) Dyazide and meclizine
   b) Ipratrpium and synthroid
   c) Ciprofloxicin and methylprednisolone
   d) Prednisone and rabeprazole
   e) Famotidine and Cisplatin

4. Understanding four physiologic mechanisms can help to prevent adverse drug reactions (ADRs) in the elderly. These mechanisms include all of the following except:

a) Chelation
b) Renal excretion
c) Absorption
d) Metabolism
e) Distribution

5. Drugs from the Beers list of inappropriate drugs for the elderly that have particular relevance in the geriatric otolaryngologic population include all of the following except:

a) Amitriptyline
b) Alprazolam
c) Diphenhydramine
d) Ciprofloxacin
e) Diazepam

Answers

1. b
2. e
3. c
4. a
5. d

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