

OPPENEER • VERVOREN

GERONTOLOGICAL PHARMACOLOGY

A RESOURCE
FOR
HEALTH
PRACTITIONERS



GERONTOLOGICAL PHARMACOLOGY

**A RESOURCE
FOR
HEALTH
PRACTITIONERS**

JOAN E. OPPENEER, R.N., M.S.N.

Professor Emerita,
University of Wisconsin-Milwaukee
School of Nursing; Consultant, Gerontological
Nursing, Milwaukee, Wisconsin

THORA M. VERVOREN, R.Ph., B.S.

Director, Pharmacy Service,
Columbia Hospital, Milwaukee, Wisconsin

The C. V. Mosby Company

ST. LOUIS • TORONTO • LONDON 1983



A TRADITION OF PUBLISHING EXCELLENCE

Editor: Julie Cardamon
Assistant editor: Bess Arends
Manuscript editor: John Middleton
Book design: Jeanne Bush
Cover design: Diane Beasley
Production: Carol O'Leary, Barbara Merritt

Copyright © 1983 by The C.V. Mosby Company

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without prior written permission from the publisher.

Printed in the United States of America

The C.V. Mosby Company
11830 Westline Industrial Drive, St. Louis, Missouri 63141

Library of Congress Cataloging in Publication Data

Oppeneer, Joan E.

Gerontological pharmacology.

Bibliography: p.

Includes index.

1. Geriatric pharmacology. I. Vervoren, Thora M.

II. Title. [DNLM: 1. Drug therapy—In old age.

WT 100 062g]

RC953.7.O66 1983 615.58'0880565 82-14423

ISBN 0-8016-3739-2

AC/VH/VH 9 8 7 6 5 4 3 2 1 01/A/086

PREFACE

Eleven percent of the nation's population is over 65 years of age, and this group uses over 25% of the prescribed drugs plus an untold number of over-the-counter medications. The amount and variety of drugs make the older person vulnerable to problems of misuse, significant interactions, and toxicity. We believe that if practitioners were knowledgeable about the aging process and drug therapy, the incidence of drug-related problems would decrease.

The purpose of this book is to provide a resource on drugs taken by older persons. To facilitate an understanding of aspects of the aging process that relate to drug therapy, the content of Chapters 1 through 7 was designed to improve the practitioner's basic knowledge in gerontology. Included in this section are current trends in gerontology, age-related physical changes, pharmacokinetics, drug interactions, misuse and abuse of medications, promoting good nutrition, and teaching the older adult. Aspects of drug therapy are a component of each chapter. Chapters 8 through 16 focus on selected health problems that are amenable to drug therapy. This section is organized according to body systems, with a brief discussion of health problems and commonly used drugs. Information about drugs includes action, dosage, and proper use and precautions. Because of the current emphasis on generic prescribing and the multiplicity of trade names, generic names are used throughout the text. Drug dosages described are within the standard adult ranges, and when documentation was available, specific geriatric dosages were included. The practitioner or student will find that the organization of Chapters 8 through 16 will make the book a useful tool in direct counseling of patients about drugs.

The book was designed for students and practitioners in nursing, pharmacy, and other health professions. As the older population increases, practitioners will continue to function in the traditional settings, hospitals and nursing homes, but there will be an increasing need for such services in community settings and wherever older people gather. This book will be a

valuable resource for professionals in helping older persons maintain optimum levels of health. This goal presents the challenge for the future.

We wish to recognize the contributions of Mary Sinclair Rice, Pharm. D., in the review of the manuscript. We also wish to acknowledge the support and assistance of Paula Meyer and Cheryl Kramer who typed the manuscript.

Joan E. Oppeneer
Thora M. Vervoren

CONTENTS

- 1 Current trends in gerontology, 1
- 2 Age-related physical changes, 7
- 3 Pharmacokinetics and aging, 21
- 4 Geriatric drug interactions, 31
- 5 Misuse and abuse of medication, 53
- 6 Promoting good nutrition in older adults, 69
- 7 Teaching the older adult, 85
- 8 Management of selected neuroemotional problems, 101
- 9 Management of selected musculoskeletal problems, 121
- 10 Management of selected endocrine problems, 137
- 11 Management of selected cardiovascular problems, 151
- 12 Management of selected respiratory problems, 177
- 13 Management of selected gastrointestinal problems, 191
- 14 Management of selected urinary problems, 203
- 15 Management of selected eye problems, 211
- 16 Management of selected skin problems, 219
- Epilogue, 227**

CURRENT TRENDS IN GERONTOLOGY

The dramatic current and projected growth of the older population has stimulated the various health professions to increase their attention to the aging process and the aging population. An examination of population trends is essential as health-care professionals consider the need for specialized knowledge in aging.

DEMOGRAPHICS

Never before have there been so many old people, either numerically or proportionately, nor have they lived to be so old. In the early 1900s life expectancy was 47 years, and today it is 75 years. During that same period, only 4% of the total population was over 65, and today the aged make up 11% of the total population. In the span of 80 years, the number of aged persons moved from one in twenty-five to one in every nine Americans. Population projections indicate an expected growth to 12% of the population by the year 2000 and to 18% by the year 2030.

The newest phenomenon of aging is the graying of the group itself. The proportion of the 75-year and older group is steadily increasing, growing to 38% in 1980. By the year 2000, the proportionate size of this group is expected to reach 44%.

Another significant change in population statistics is the growth of the 85-year and older group, which has increased to approximately 2 million and produced a 47% increase in 7 years. This rate of growth will continue to increase in the next decades. The old-old group, or persons over 85, is especially vulnerable to physical, emotional, and social problems.

More people are reaching old age because of advances in medicine, public health measures, increased health awareness, and improved living conditions. These advances have contributed to the elimination of the disastrous

effects of childbirth and childhood diseases and infectious diseases such as cholera, smallpox, and diphtheria. Interestingly, these problems have been fairly well controlled, but with the increasing incidence of chronic illnesses, overall life expectancy has not increased as much as one would expect. Since 1900, life expectancy at birth has increased 25 years and many more people reach age 65, but once there, they can only expect to live about 4 years longer. If illnesses such as cancer and heart disease, which are today's major killers, were eradicated, life expectancy would be further increased. The great increase in the number of aged Americans has a significant effect on the health professions because this growing group will put greater stress on our health-care system as additional services are required.

Sex, marital status, and living arrangements

Women have consistently lived longer than men, which means that there is a discrepancy between the number of men and women that widens with age. At age 65, there are 13 women to every 10 men, and at age 85, 22.4 women for every 10 men. This discrepancy reflects an 8-year difference in the life expectancy of men and women. Women can expect to live 77 years, whereas men can expect to live to age 69. As a result of this age difference, most older men are married (77%), and most older women are widows (52%). This difference increases with age, so 70% of women over 70 are widows (*Facts About Our Older Americans*, 1978).

Marital status contributes to the type of living arrangement chosen by older persons. Of noninstitutionalized men over 65 in 1975, 79% were married and living with family members. Only 17% were living alone or with nonrelatives. By contrast, only 39% of the women of the group were married, and 41% were living alone or with nonrelatives (Somers, 1980). Only 5% of the aged live in institutions, although this number increases to 20% for the over-85 group. However, 20% of all old people can expect to live in a nursing home at some time, and the probability increases to over 50% for persons over 85.

Because of the higher concentration of older persons in the sun belt states, a common misconception exists that most move to this area. Most older persons continue to live in the neighborhoods where they lived during their middle years. They are not a mobile group, and this stability may be economically mandated. A concentration of persons exists in the older homes in the central city as well as in the rural areas. Older persons living in the suburbs can expect more problems with transportation and provision of health services than their peers living in the cities.

Economics

Poverty, not only low income, is a fact of life for millions of the older population. In 1979, 15% of the over-65 group were poor according to the official definition (\$4364 for the household of an older couple or \$3472 for an older person living alone). Women and minority elderly are heavily represented in this group. About 35% of elderly blacks and 28% of elderly Hispanic persons were poor.

Inadequate income in later years is a major problem confronting older people. The income of persons over 65 is less than half that of groups under 65. This insufficient income places great stress on older persons, whose expenses for medications and health services increase. Problems of noncompliance, malnutrition, and generally poor health care may be partially attributed to low financial status.

Educational status

The level of education achieved by this group is significant to health-care workers who are providing health information. The years of formal education are less, with 4% of the 65 and older group having received no formal education, and 54% having completed the eighth grade. Approximately 84% of blacks in this group have less than a high school education. A broad gap in communication may exist between the older person and the health professional. Health-care providers need to carefully assess the abilities of older persons because some of them are educated to a sophisticated level, whereas others may be unable to read.

Health status

Aging does not cause specific diseases, but certain chronic illnesses are more prevalent among older adults. Hypertension, heart conditions, neuromuscular disorders, mental conditions, digestive conditions, circulatory problems, diabetes, and ear and eye conditions are among the major health problems of older persons. Conversely, acute illnesses are less common among this group. Chronic and degenerative diseases are the major diagnoses and the primary causes of death. Diseases of the heart, malignant neoplasm, and cerebrovascular disease are the leading causes of death. Chronic illness becomes more prevalent, with 80% of persons over 65 reporting one or more illnesses. The presence of multiple pathological conditions and the manifestation of symptoms that are different from younger persons increase the problems of diagnosis and management.

Despite the frequency of chronic illness, only 46% of this group have activity limitations because of the illness, and 40% are limited in major activities (Brody, 1980). The slow onset of many of the illnesses has permitted the older person to adapt successfully to body changes and maintain self-care in daily activities. Vulnerability to illness increases with age, resulting in decreased ability to function and increased need for services. Shanas (1979) estimates that about one fourth of the elderly residing in the community require home-care services, which includes the 15% who are bedfast, home-bound, or cannot go out without difficulty.

With an increased focus on health awareness, the older adult group also has participated in self-assessment. Despite the high percentage of chronic illness, most elderly view themselves as healthy when compared with others their own age. Self-health assessment may be more significant than the professional evaluation of medical status in predicting general emotional state and behavior. Approximately two thirds of this group rated their health as excellent or good, whereas poor health was reported by 9% of the population studied. The statistics from health assessment as well as functional assessment indicate that the elderly are not frail and sick but that wide variability exists within the group.

IMPACT ON THE HEALTH-CARE SYSTEM

The elderly population makes up 11% of the U.S. population but uses more than 27% of the health-care dollar, a percentage that continues to rise (Lamy, 1980). The use of services is reflected in utilization of institutional facilities, with approximately 30% of the persons in general medical-surgical units over age 65. Most persons in nursing homes are also over age 65. In 1975, 18% of the older population was hospitalized. As age increases, the rate of hospitalization and the average length of stay per patient increase. Older people, regardless of the type of illness or injury, tend to be confined to bed and restricted in activity longer than younger persons do. The period of recovery is longer because the aged body responds more slowly to the stresses of illness.

The increased number of older persons in nursing homes is also significant. Persons up to the age of 64 spend minimum time living in nursing homes, but that number progressively increases, with persons 65 to 74 requiring 4.4 days per year, persons 75 to 84 requiring 21 days per year, and persons over 85 requiring 86.4 days per year (Lamy, 1980). Factors increasing the need for institutionalization are living alone, never having been married or being separated, having few or no children, and being female.

Older persons visit physicians only slightly more often than younger peo-

ple do, despite the greater frequency of chronic illness and impairment. The elderly accounted for 13% of all physician visits in 1975. The average number of visits that year for all ages was 5.1; persons 65 and over averaged 6.6 visits. The percentage of persons visiting a physician during a given year was similar for all age groups (Yurik, 1980). Most physician visits occur in offices, but with the rising cost of health care, many persons receive care in outpatient clinics. Patients are beginning to seek alternative forms of health care from newly emerging groups of health-care professionals. Geriatric nurse practitioners certified by the American Nurses' Association provide primary care to older persons. Unfortunately, many persons do not seek care because of economic reasons, lack of qualified practitioners, and general discontent with the health-care system. The infrequency of health-care visits may be partially responsible for noncompliance and other drug problems that commonly occur in this population.

As the percentage of older persons with chronic illness increases, so will the use of drugs, placing an added burden on the financial status of the individual and society. Chronic illness requires the use of drugs, not for cure but to control symptoms or to control progression of the disease. Consequently, older persons receive 25% of all prescription drugs. In the early 1970s, older persons received an average of 13 to 14 prescription drugs per year, and in 1979 that number had increased to 17.9 (Butler, 1981). The cost of drugs can be staggering for persons with fixed incomes for whom chronic illness extends over a number of years. For example, the approximate annual cost for the arthritic patient taking ibuprofen is \$400; for the hypertensive patient taking propranolol, \$275; and for the depressed patient taking amitriptyline, \$200. It has been estimated that 20% of the older person's out-of-pocket expenditures are for medicines.

Impact on the health professions

The health professions are responding to the growing older population through the institution of courses that increase the professional's expertise in working with older patients. Selection of practice sites in clinics, nursing homes, gerontology-geriatric centers, and the more traditional hospital settings provides opportunities to use this expertise in direct patient contact. Continuing education courses for health practitioners in the areas of aging are beginning to fulfill the need for persons already in professional practice. These offerings for students and practitioners must expand and be made more available if the elderly are to be better served. Predictions indicate that current graduates of professional programs may find that by the year 2000, 60% to 70% of patients will be elderly.

If more of the older persons are to be cared for in their homes, practitioners will need to be aware of the multiple health problems that can occur. The detection of alterations in health, through skillful observations of signs and symptoms and responses to medications, is the responsibility of nurses, pharmacists, and other professionals. These same people may become involved in community primary prevention services that are designed to prevent disease from occurring through good health-care practices. Reimbursement for health promotion services by government and private agencies will provide an incentive for development and continued expansion.

Having an understanding of who old people are, where they live, what their characteristics are, and what their health status is provides background information that gives insight into the needs of older persons. This is only the beginning. To better understand and meet these needs, especially as they relate to pharmacology, the practitioner must understand the changes that take place in the aging body, the pharmacokinetics of aging, common health problems and related drug management, strategies for teaching individuals and groups about medications, and problems of drug abuse.

Health practitioners share a common core of knowledge, and part of this core should be in the area of gerontology, the study of the aging process. Beyond the common core, each professional brings expertise that must be shared with well and ill older persons and with other professionals.

If health-care professionals are to be influential in providing the care older people deserve, they must expand their knowledge, become involved in research efforts, be aware of national health policy that affects older persons and the professions, and generally become advocates for the aged.

REFERENCES

- Brody, S.J.: The graying of America, *Hospitals* **54**:63, 1980.
 Butler, R.N.: Pharmacy's contribution to geriatric care, *Drug Intell. Clin. Pharm.* **15**:569, 1981.
 Lamy, P.: Prescribing for the elderly, Littleton, Mass., 1980, John Wright-PSG, Inc.
 Shanas, E.: Social myth as hypothesis, *Gerontologist* **19**:13, 1979.
 Somers, A.: Demographics can help guide social policy, *Hospitals* **54**:67, 1980.
 U.S. Department of Health, Education, and Welfare: Facts about our older Americans, Pub. No. (OHDS) 79-20006, Washington, D.C., 1978, U.S. Government Printing Office.
 Yurik, A., and others: The aged person and the nursing process, New York, 1980, Appleton-Century-Crofts.

SUGGESTED READINGS

- Atchley, R.: The social forces in later life, ed. 3, Belmont, Calif., 1980, Wadsworth Publishing Co.
 Butler, R., and Lewis, M.: Aging and mental health: positive psychological approaches, ed. 2, St. Louis, 1979, The C.V. Mosby Co.
 Hendricks, J., and Hendricks, C.: Aging in mass society, Cambridge, Mass., 1977, Winthrop Publishers, Inc.
 Rossman, I., editor: Clinical geriatrics, ed. 2, Philadelphia, 1979, J.B. Lippincott Co.

AGE-RELATED PHYSICAL CHANGES

Because of the interrelatedness of all body systems, the process of aging has a distinct effect on each system. Having the knowledge of these various changes that usually occur with aging, the health professional can more readily anticipate the action drugs may produce on the aging body. The practitioner can also discuss with the patient those changes that are age related and suggest medical referral for those that appear to be due to pathological conditions.

Age-related changes begin at birth and continue throughout life. These changes that occur in body tissues differ in nature and time of occurrence. Alterations, which are very individualized to each person, may be so gradual that the person adapts to them, and unless some stress is placed on the body or body system the person may be unaware of the change.

Goldman (1979) has identified four characteristics of aging as (1) universal, (2) progressive, (3) decremental, and (4) intrinsic. The universality of aging removes it from consideration as a merely pathological condition and identifies it as a natural phenomenon. Because of the simultaneous occurrence of multiple pathological conditions with aging, differentiation of normal aging becomes a difficult process. Longitudinal studies extending from middle to old age will continue to verify normal aging changes. The progressive and decremental characteristics decrease the ability of the person to interact with the environment and relate to the increasing risk of approaching death. Most of the aging changes are intrinsic and will occur in a definable pattern, but extrinsic factors are also responsible for a host of changes and may hasten those related to age.

This chapter presents the identified normal age changes of each body system in the older adult. The information will be useful in planning intervention strategies, providing health education programs to individuals and groups, and discussing patients with other groups of health professionals.

Specific suggestions for intervention strategies are included with each system.

GENERAL APPEARANCE

The body tissue that undergoes the greatest change throughout life is fat (Rossman, 1979). The subcutaneous fat that fills out and rounds the body shows a general decrease in older age. As a result, contours become more sharp, hollows more apparent, and bony landmarks more prominent. Peripheral body parts also evidence these changes. Legs and arms appear thin in relation to the abdomen. Tendons, bones, and vessels of the feet and hands become more apparent when the fatty layer diminishes. The fatty layer around the eye orbit disappears, giving the eyes a deep or sunken appearance. Formerly firm breast tissue begins to atrophy with the resultant sagging, pendulous breasts characteristic of older women.

General changes in body composition that show a decrease include plasma volume, total body water, and extracellular fluid. Surprisingly, total body fat increases, but total body weight decreases, which is due primarily to a decrease in lean body mass.

Recommendations for intervention

Since subcutaneous fat helps to insulate the body, its loss causes the older person to chill more readily. This change, coupled with the generally lowered ability in thermoregulation, may make the adjustment to cool temperatures more difficult and possibly hazardous. Attention must be given to requests for warm clothing, extra blankets, and warmer room temperature. Older persons who go outdoors in cold weather must be protected from chilling. More vulnerable persons in this group are those whose activity is restricted by disability and the effects of drugs such as central nervous system (CNS) depressants.

INTEGUMENTARY SYSTEM

Changes in the skin, hair, and nails are the most evident alterations in the aging body.

Skin

Wrinkled skin, particularly of the face and neck and exposed body parts, may be one of the first signs of aging. Factors influencing the onset of these

wrinkles are skin elasticity, maintenance of subcutaneous fat, exposure to the sun and heat, and the general state of nutrition and health. The epithelial layer of the skin thins, and collagen becomes more rigid. Loss of body fat intensifies the wrinkling, and the skin becomes more lax because of loss of elasticity.

The gravitational pull is responsible for changes that affect the eyelids, ears, jowls, and general facial expression. Skin color may change to a uniformly pale tone, which is affected by changes in the capillaries. Areas of the body exposed to extensive sun radiation may become yellowish and leathery. The brown pigmented spots appearing on the hands, wrists, and sometimes the face are known as senile lentigo. These harmless areas are commonly known as liver spots but have no relationship to the liver.

Nails

Nail growth decreases with age, and the nails become hard, thick, and brittle. The latter changes are probably related to changes in peripheral circulation and are complicated by the presence of fungal infections of the nail beds.

Hair

Hair, which undergoes changes in color, texture, and distribution, is affected by genetic, endocrine, and age factors. A change in hair color to gray, beginning at the temples, is caused by decreasing amounts of melanin in the hair itself. In both sexes, facial hair tends to increase, while hair on other parts of the body decreases and may eventually disappear. Balding occurs in varying amounts in both men and women and follows a characteristic pattern with loss at the vertex and frontal areas. The pattern of balding is sex linked, with the mother passing the trait on to her sons.

The loss of pubic and axillary hair in women is probably related to hormonal changes and begins in the postmenopausal period. The fine hair on the ears of young men changes to coarse, longer hairs located primarily on their ear lobes as they become old men.

Recommendations for Intervention

Prevention has a definite role in the degree of skin change that occurs. Protection from the sun's rays, maintenance of body weight, good nutrition, and exercise, particularly of the facial muscles, do have a positive effect. Informing the younger patient of these measures of prevention and helping

the aging patient regarding expected changes in the integumentary system are clearly professional responsibilities. The older person should be made aware of the need for fewer baths, the use of emollients after the bath, and drying the skin by blotting with an absorbent towel. Inexpensive lotions and creams will prevent some of the extreme dryness and flaking that may occur. However, even expensive creams and lotions will not prevent the eventual skin changes.

Caring for hard, rigid toenails may be problematic for older persons who have visual and musculoskeletal changes. The elderly diabetic patient is especially vulnerable to nail and foot problems. When the nails are soft following a bath, they should be cut straight across. The assistance of another person or the services of a podiatrist may be recommended. Recommendations for foot care are included in a later chapter in this book.

MUSCULOSKELETAL SYSTEM

The more apparent changes in the musculoskeletal system that affect the person's functional ability include loss of muscle strength, flexibility, equilibrium, and speed of motion.

Height and posture

A progressive decline in height, particularly in the trunk, becomes evident in persons of both sexes as they become older. In the middle years as the spongy intervertebral disks begin to shrink, a decrease in stature becomes evident. In the later years, especially in women, the vertebrae begin to narrow, and the characteristic appearance of a shorter trunk with long arms and legs occurs. The narrowing of the vertebrae is caused by fracture and collapse associated with osteoporosis. Kyphosis combined with loss of height is compensated for by a backward tilting of the head, which further reduces the occiput-to-shoulder distance. Another postural change contributing to changes in height is slight flexion of the knees and hips. These alterations in height and posture have a distinct effect on the person's mobility and equilibrium. In addition, changes in posture affect the functioning of body organs.

Muscles

Atrophy of muscle fibers that are replaced by fat results in decreased strength, flexibility, and endurance. Changes in muscle strength are particularly prominent in the arms, legs, and back, with back pain a common complaint.

Bones

The bones, deprived of adequate absorption of calcium and affected by the lack of the necessary stress achieved by exercise, become porous and brittle. Osteoporosis may occur and increases the incidence of fractures, particularly among women, and is a major cause of morbidity and mortality in the aged.

Recommendations for intervention

Because persons who exercise regularly do not lose as much bone or muscle mass, a regular program of exercise for all persons is recommended. Group exercise programs led by a capable health professional have proven to be effective. The concern for general mobility and possible loss of equilibrium may necessitate the use of a cane, chair, walker, or other means of support when walking or exercising. Changes in lean body mass that may affect the distribution of drugs necessitates careful observation.

NERVOUS SYSTEM

The aging process affects the structure and function of the CNS, but the reserve capacity of the cells permits the brain to function adequately when the person is not exposed to stressful conditions. Clinical manifestations are seldom exhibited except when the person is exposed to stress, electrolyte imbalance, poor nutrition, depressant drugs, and disruptive experiences.

Neuronal changes

Because neurons are postmitotic, they are not replaced when lost. The rate of loss differs for different parts of the brain. Fortunately, humans have a very large number of cells, far more than will ever be used in a lifetime. Since brain cells decrease by about 1% per year after the age of 50, a person of 70 may have lost 20% of them. The loss of thousands of cells daily does not necessarily affect functioning or impair behavior. The cells that remain also undergo some changes that may compromise functioning. Lipofuscin, a brownish pigment in nerve and other body cells, accumulates in the nerve cells, and the quantity correlates with age. However, it is not known if it has any effect on cell function.

Brain circulation

Age-related changes that occur in cerebral blood flow and use of oxygen have been well studied. Goldman (1979) reports that the following progres-