GERIATRIC MEDICINE

Dr. B. Goldlist
Grant Chen and Christine Cserti, editors
Cheryl Wein, associate editor

DEMOGRAPHICS

Notes

AGE PROFILE

- ❑ currently about 12% of the Canadian population is 65+ years of age
- ❑ by 2030, this age group will make up 25% of the population
- ❑ the 85+ age group is the fastest growing segment of the Canadian population, increasing at an average rate of about 4% per year

GENDER

- ❑ ratio of elderly females to males in Canada is 1.4:1
- ❑ this ratio increases to 2:1 for those age 85+

MARITAL STATUS

- ❑ widows outnumber widowers 5:1
- ❑ males over 65 are twice as likely to be married compared to females of the same age group

LIVING ARRANGEMENTS

- ❑ about 5% of the elderly population live in long-term care (LTC) institutions
- ❑ 1% of persons aged 65-74 live in LTC institutions
- ❑ 20% of persons aged 85 or older live in LTC institutions

HEALTH STATUS

- ❑ 64% of seniors rate their health as good, very good or excellent
- ❑ 92% of seniors say that they are “pretty happy” or “very happy”
- ❑ 51% of seniors report daily or frequent exercise
- ❑ 99% of seniors would have sex if a partner was available

CAUSES OF MORTALITY AND MORBIDITY AMONG THE ELDERLY

Table 1. Causes of Mortality and Morbidity among the Elderly

Mortality (in descending order)	Morbidity (in descending order)
1. heart disease	1. arthritis
2. malignancy	2. hypertension
3. stroke	3. hearing impairment
4. dementia	4. heart disease
5. COPD	5. visual impairment
6. pneumonia (usually secondary)	
7. accidents	
8. diabetes mellitus	

AGING CHANGES IN BODY SYSTEMS

IN GENERAL

- ❑ rule out disease processes before attributing changes to aging
- ❑ most physiological functions decline with age, with considerable variation among individuals
- ❑ elderly generally have less reserves resulting in diminished ability to respond to stressors

CARDIOVASCULAR SYSTEM

- ❑ decreased beta-adrenergic response, heart rate, reflex tachycardia, cardiac output
- ❑ impaired myocardial diastolic function (due to increased stiffness of walls)
- ❑ increased TPR, stroke volume and stiffness of the major arteries

- ❑ increased afterload and systolic blood pressure
- ❑ most dysfunction caused by disease, NOT normal aging

RESPIRATORY SYSTEM

- ❑ decreased lung compliance
- ❑ collapse of small airways
- ❑ increased ventilation-perfusion imbalance
- ❑ age-related changes alone do not lead to significant impairment because of large physiological reserves

GASTROINTESTINAL SYSTEM

- ❑ most common changes are dental (e.g. gum recession, tooth loss)
- ❑ peristalsis is decreased but is rarely the sole cause of constipation
- ❑ decreased gastric acid secretion and moderate small intestine villous atrophy but no significant malabsorption
- ❑ decrease in liver and pancreatic function is not clinically significant
- ❑ physiologic anorexia (?neuromodulator-mediated) among the very elderly

RENAL AND UROLOGIC SYSTEMS

- ❑ decrease in: renal mass, GFR, renal tubular secretion and concentrating ability, bladder capacity
- ❑ increase in: post-void residual volume, uninhibited bladder contractions, nocturnal sodium and fluid excretion
- ❑ clinical manifestations: decreased drug clearance, more frequent incontinence, nocturia, predisposition to bacteriuria

REPRODUCTIVE SYSTEM

- ❑ decreased production of estrogens, androgens and precursors
- ❑ decreased vaginal secretions resulting in atrophic vulvovaginitis
- ❑ decreased size of uterus, ovaries and breasts
- ❑ benign prostatic hypertrophy
- ❑ chromosomal abnormalities in germ cells

NERVOUS SYSTEM

- ❑ decrease in: brain weight, cerebral blood flow, neurons, neurotransmitters (dopamine, GABA) and neurotransmitter receptors (for dopamine, acetylcholine, cortical serotonin)
- ❑ increase in lipofuscin pigment in neurons (significance unknown)
- ❑ alterations in sleep cycle stages and organization, more wakefulness
- ❑ decreased baroreflex sensitivity (increased risk of syncope)
- ❑ decreased pain, temperature, and vibration sensitivity
- ❑ slower DTRs

SENSORY SYSTEMS

Ophthalmic (see Ophthalmology Notes)

- ❑ increased rigidity of iris, decreased size of anterior chamber
- ❑ accumulation of lipofuscin in lens, reduced lens elasticity
- ❑ retinal deterioration
- ❑ reduced periorbital fat
- ❑ clinical manifestations: decreased pupil size, altered colour perception, increased risk for open angle glaucoma, presbyopia (decreased ability to accommodate), impaired adaptation to darkness, enopthalmia

Auditory (see Otolaryngology Notes)

- ❑ presbycusis (loss of cochlear neurons resulting in hearing loss for higher frequencies)

Olfactory and Gustatory

- ❑ blunted sense of taste and smell exacerbate malnutrition and anorexia, while predisposing to food/toxin poisoning

Notes

MUSCULOSKELETAL SYSTEM

Table 2. Musculoskeletal System Changes

Decreased	Clinical Manifestations
lean body mass	decreased muscle strength
myofibrils	
glycolytic oxidative enzyme activity	
bone density	
osteoblastic activity (decreased more than osteoclastic activity)	increased risk of osteoporosis, osteoarthritis, degenerative disk disease
repair of microfractures	
chondrocyte activity	

Note: disuse may cause as many MSK changes as aging

SKIN AND CONNECTIVE TISSUE

- ❑ decrease in: dermal vascularity and density, epidermal turnover, melanocytes, dermal-epidermal junction contact and rete peg undulations, immune responsiveness, secretions, vitamin D synthesis
- ❑ loss of collagen and increased glycosaminoglycans
- ❑ clinical manifestations: increased shear injury, prolonged wound healing and poor insulation, wrinkling, dryness, sallowness, irregular pigmentation, purpura, telangiectasia

GERIATRIC ASSESSMENT

- ❑ appraisal of health and social status
- ❑ focus on improving function
- ❑ generate management plan
    - medical illness, risk factors, problem list, proposed interventions, prevention and health promotion strategies

IMPORTANCE OF FUNCTION IN GERIATRIC MEDICINE

- ❑ illness often presents atypically, as a change in function
- ❑ functional impact prioritizes the approach and signifies treatment effectiveness

FUNCTIONAL ASSESSMENT

- ❑ identify problem areas (see below)
- ❑ obtain corroborative data from caretakers and/or observe functional tasks

ADL (Activities of Daily Living)

- ❑ self care: eating, dressing, grooming, toileting, bathing
- ❑ transfers: bed, bath, chair
- ❑ ambulating: stairs, in and out of house, use of aids

IADL (Instrumental Activities of Daily Living)

- ❑ household: cooking, cleaning, laundry, telephone, self-medication
- ❑ outside: banking and financial decision making, transportation, shopping

COMPONENTS OF A GERIATRIC ASSESSMENT

- ❑ contains: history, complete physical exam, mental status exam

HISTORY

- ❑ from patient and corroborative sources (e.g. family, friends, police, referral source)

History of Present Illness
- ❑ often multiple issues and non-specific symptoms
- ❑ one decompensating factor may have many manifestations
- ❑ determine impact on function

Past Medical History
- ❑ obtain past medical records for comparison
- ❑ note impact of past illnesses on patient's overall function

Medications
- ❑ over-the-counter drugs, borrowed drugs and out-of-date prescriptions must be included
- ❑ determine why drugs are being used and if they are effective
- ❑ remove unused, outdated and ineffective drugs
- ❑ ask about vaccination status

Social History
- ❑ screen for social isolation, suitability and safety of home, substance abuse
- ❑ financial status, educational and occupational history (helps in the interpretation of cognitive tests)
- ❑ caregiver status
  - primary caregiver's health and responsibilities
  - assess for caregiver burnout and elder abuse
- ❑ note support structures and services

Table 3. Review of Systems Important in the Elderly

Organ system	Symptoms
general	nutrition, appetite sleep patterns falls
head and neck	visual changes hearing loss
GI	constipation
GU	incontinence sexual function
neurologic	gait
psychiatric	memory loss depression

PHYSICAL EXAMINATION
- ❑ organize yourself so there is minimal repositioning of the patient
- ❑ record weight and height (loss may indicate osteoporosis)
- ❑ vital signs (check for orthostatic changes in blood pressure)
- ❑ head and neck
  - visual acuity
  - screen for cataracts, macular degeneration, and glaucoma
  - assess hearing
  - look for ear wax (wax impaction can result in a 30% conductive hearing loss)
  - look for dryness, dental and periodontal problems, and oral cancers
  - Tip: Ask patient to remove dentures when examining the mouth
  - thyroid

Notes

- ❑ cardiorespiratory
  - auscultate for carotid bruits, murmurs (aortic sclerosis and aortic stenosis), extra heart sounds (valvular and myocardial pathology), and rhythm (AF, heart block)
  - chest configuration (kyphosis)
- ❑ abdomen
  - urinary retention
  - abdominal aortic aneurysm
  - hernial orifices
  - rectal examination/prostate
- ❑ pelvic
  - cystocele, rectocele
  - atrophic vaginitis
- ❑ skin
  - rashes, pressure sores, leg ulcers/edema
- ❑ musculoskeletal
  - range of motion of joints, especially hips and shoulders
  - foot hygiene, deformity, assess need for chiropody
- ❑ neurologic
  - gait, balance, and transfers
  - ask patient to get up from sitting in a chair, walk to one side of the room, turn, return to the chair, and sit back down in it (get up and go test, timed test)
  - position and vibration sense
  - primitive reflexes
- ❑ mental status exam
  - Folstein Mini-Mental Status Exam (if scores < 24/30, suspect dementia)
  - Geriatric Depression Scale, or screening question "Do you often feel sad or depressed?"
- ❑ functional assessment
  - observe the patient's ability to undress and dress, transfer to the examining bed, and ambulate
  - personal functional level (appropriateness of footwear care, ambulatory aids)
  - may include assessment of home environment

INVESTIGATIONS

- ❑ the following yield a high proportion of abnormal results in an ambulatory clinic of elderly persons
  - CBC, glucose, BUN, creatinine
  - ESR, vitamin B_{12}, TSH

PROBLEM LIST

- ❑ include both short-term and long-term problems
- ❑ serves as a checklist for the physician to
  - monitor outcomes
  - re-evaluate medical/functional status
  - create up-to-date care plans

- ❑ maintain and improve function and independence for the elderly
- ❑ multidisciplinary team sees patients either at home or on site

ACUTE IN-PATIENT SERVICES
- ❑ short-term diagnostic investigation and treatment
- ❑ multidisciplinary team addresses medical and social issues
- ❑ core team meets regularly to discuss clinical cases and program development

OUTREACH PROGRAMS
- ❑ assessment of home or long-term care facility
    - suitability and safety
    - attitudes of other people in home or long-term care facility
    - emergency assistance arrangements
    - nutritional, alcohol, hygiene habits
    - ability to perform ADL and IADL
- ❑ effective use of outreach programs avoids unnecessary hospital admissions

DAY HOSPITALS
- ❑ multidisciplinary team and patient can undertake investigations, rehab, medical treatment, and maintenance care
- ❑ aid in transition to full home discharge of patients
- ❑ prevent early readmission

OUT-PATIENT CLINICS
- ❑ clinics that specialize in specific disorders associated with aging
    - e.g. memory clinics, continence clinics, osteoporosis clinics

COMMON MEDICAL PROBLEMS OF THE ELDERLY

IN GENERAL
- ❑ severe, acute illnesses often present with vague symptoms (i.e. confusion, anorexia)
- ❑ elderly frequently have atypical presentation of illness
- ❑ the brain is more susceptible to effects of illness and its treatment

FALLS
- ❑ 1/3 of elderly in the community, 20% of hospitalized and 45% of elderly in long-term institutions
- ❑ most common cause of accidents and mortality due to injury in the elderly
- ❑ 15-50% mortality one year after admission to hospital for fall
- ❑ complications: soft tissue injuries with a decrease in function, fractures (hip, Colles', compression), subdural hematoma
- ❑ fear of falling can be severely debilitating and can cause self-protective immobility (see Immobility section)

Extrinsic Etiologic Factors
- ❑ identified as a major factor in almost half of all falls
- ❑ ground surfaces, lighting, stairs, bathroom, bed, chairs, shelves
- ❑ medications (sedatives, anticholinergics, neuroleptics, antihypertensives), ethanol

Intrinsic Etiologic Factors
- ❑ physiological changes
    - decreased auditory and visual acuity

- decreased night vision and glare tolerance
- slower reaction time
- diminished sensory awareness of light touch
- increased body sway and impaired righting reflexes

Table 4. Pathological Changes Contributing to Falls in the Elderly

System	Condition
cardiovascular	MI, arrhythmia orthostatic hypotension
neurologic	stroke, TIA dementia, Parkinson's, seizures neuropathy
gastrointestinal	bleeding, diarrhea
metabolic	hypoglycemia, anemia dehydration
musculoskeletal	myositis, muscle weakness arthritis
drug-induced	diuretics, antihypertensives, sedatives
genitourinary	incontinence, micturition syncope
psychologic	depression, anxiety

History

❑ location and activity at time of fall, witnesses
❑ associated symptoms: dizziness, palpitations, dyspnea, chest pain, weakness, confusion, loss of consciousness
❑ previous falls, weight loss (malnutrition)
❑ past medical history and medications

Physical Examination

❑ complete physical exam with emphasis on
  - cardiac: orthostatic changes in blood pressure and pulse, arrhythmias, murmurs, carotid bruits
  - musculoskeletal: assess for injury secondary to fall, degenerative joint disease, podiatric problems, poorly fitting shoes
  - neurologic: vision, hearing, muscle power and symmetry, sensation, gait and balance, walking, turning, getting in/out of a chair, Romberg test and sternal push, cognitive screen (if appropriate)

Investigations

❑ directed by history and physical exam
❑ common tests
  - CBC, lytes, BUN, creatinine, blood glucose
  - TSH, vitamin B_{12}, ESR
  - urinalysis
  - cardiac enzymes, ECG

Management

❑ multidisciplinary (social work, OT and PT referrals may be required)
❑ treat underlying cause(s) and any known complications

- ❑ modify risk factors: reassess meds, need for mobility aids, environment
- ❑ educate patient and family members with regards to: nutrition, exercises to improve balance and gait (e.g. Tai Chi)

IMMOBILITY

- ❑ complications associated with immobility
    - DVT, pulmonary embolus, pneumonia
    - pressure ulcers
    - muscle deconditioning and atrophy, contractures
    - loss of coordinated balance and righting reflexes
    - dehydration, malnutrition
    - constipation, fecal impaction, urinary incontinence
    - depression, delirium, loss of confidence

Management

- ❑ prevention: reposition patient periodically, inspect the skin frequently, active and passive range of motion exercises
- ❑ treat the underlying cause
- ❑ environmental factors: handrails, lower the bed, chairs at proper height with arms and skid guards, assistive devices
- ❑ to maintain and improve function and independence
- ❑ a multidisciplinary team sees patients either at home or on site

URINARY INCONTINENCE

- ❑ estimated prevalence 30% of community-dwelling and 75% of institutionalized seniors
- ❑ frequently accepted, under-reported and under-treated, can lead to isolation
- ❑ many causes of incontinence are treatable (see Urology Notes)
- ❑ mnemonic: **DRIP**
    - **D:** Delirium/ Diabetes/ Drugs (long-acting sedatives, anticholinergics, diuretics)
    - **R:** Restricted mobility/ Retention (neurogenic detrusor impairment)
    - **I:** Infections (UTIs)/ Impaction of stool
    - **P:** Psychological/ Post-menopausal effects (prolapse)/ Prostate

POLYPHARMACY

- ❑ greater burden of chronic illnesses leads to more drug utilization
- ❑ Adverse Drug Reactions (ADRs)
    - the elderly hospitalized are given an average of 10 drugs over admission
    - important age-associated complications
        - upper GI bleeding secondary to NSAIDs
        - hip fracture after falling secondary to psychotropic drugs
    - 90% of ADRs from the following: ASA, other analgesics, digoxin, anticoagulants, diuretics, antimicrobials, steroids, antineoplastics, hypoglycemics
- ❑ drug interactions
    - drug-drug, drug-disease, drug-nutrient risk factors
        - multiple drugs: adverse reaction rate is 5% for fewer than 6 drugs but > 40% with over 15 drugs
        - changes in pharmacokinetics and pharmacodynamics

- ❑ non-compliance
  - risk is not as age-related as it is drug-related (number, dosing frequency)
  - compliance with 1 drug up to 80% but only 25% with 4 drugs
  - high risk because of multiple:
    - physicians
    - drugs and doses
    - diseases
  - important consequences
    - disease relapse
    - adverse effects
    - increased hospitalizations and medical costs
  - bubble packs or dosette systems can improve proper drug use
- ❑ a pharmacist is a helpful team member when
  - choosing appropriate medications
  - recommending alternatives
  - advising patients
  - monitoring compliance

DELIRIUM, DEPRESSION, AND DEMENTIA

(see Psychiatry Notes)

ELDER ABUSE

- ❑ 4% in Canada are victims of abuse or neglect
- ❑ only 15% of abuse is reported
- ❑ perpetrators are often individuals whom the older person is dependent upon

MALNUTRITION

- ❑ be concerned with involuntary weight loss of 10% in last 6 months

Risk Factors

- ❑ sensory decline
- ❑ poor oral hygiene
- ❑ disease
- ❑ medications: polypharmacy, drug-nutrient interactions
- ❑ social isolation
- ❑ poverty
- ❑ substance abuse (EtOH)

Management

- ❑ monitor height and weight
- ❑ reassess medications
- ❑ community services: meals on wheels, home care, congregate dining
- ❑ dietitian, social work, occupational therapy

HAZARDS OF HOSPITALIZATION

- ❑ immobilization, high bed and rails
  - inactivity contributes to deconditioning and falls
  - dependency for daily functions
- ❑ reduced plasma volume from bed rest
  - predisposes to syncope, dizziness, falls and fracture

- ❑ accelerated bone loss with bed rest
  - increased fracture risk
- ❑ urinary incontinence
  - unfamiliar environment with barriers (bed rails, IV line, oxygen, etc...)
  - may lead to catheter use and family rejection
- ❑ effects on fragile skin
  - pressure sores (especially sacral and heel)
  - high shearing forces (being moved up in bed)
  - potential for infection
- ❑ decreased sensory input
  - isolation, lost glasses, lost hearing aid, sensory deprivation
  - delirium and possibly: false labeling, physical or chemical restraints
- ❑ malnutrition and dehydration
  - unappealing therapeutic diets
  - difficulty eating in bed (trays, utensils and water not easily accessible); misplaced dentures
- ❑ end result of hospitalization of many elderly patients is nursing home placement
- ❑ recommendations
  - encourage ambulation (low beds without rails)
  - reality orientation (clocks, calendars)
  - increased sensory stimulation (proper lighting, eyeglasses and hearing aids)
  - team management, early discharge planning

GERIATRIC PHARMACOLOGY

- ❑ physiologic changes associated with aging affect pharmacodynamics and pharmacokinetics

PHARMACOKINETICS

Absorption

- ❑ unaltered in patients with an intact gastric mucosa

Distribution

- ❑ decreased body water content
  - increased serum concentration + longer activity of water soluble drugs
- ❑ increased body fat
  - longer pharmacological activity of highly lipid soluble drugs
- ❑ decreased serum albumin
  - more free drug available with highly protein bound drugs
- ❑ increased α1glycoprotein (an acute phase reactant)
  - enhanced binding of basic drugs (lidocaine)

Metabolism

- ❑ function of the microsomal mixed-function oxidative system declines with age, resulting in decreased metabolism of drugs
- ❑ conjugative processes do not appear to be altered
- ❑ decreased hepatic size and blood flow may reduce drug metabolism even if LFTs are normal

Notes

Elimination

- ❑ beginning in the fourth decade of life, there is a 6-10% reduction in GFR and in renal blood flow (RBF) every 10 years
- ❑ a decline in Cr due to a decline in muscle mass may mask the reduction in GFR
- ❑ reduced tubular excretion
- ❑ hypertension is common and can reduce renal function
- ❑ drugs eliminated primarily by renal excretion should be dosed differently: for every X% clearance reduction, dose often decreased by X% and interval increased by X%
- ❑ common drugs eliminated primarily by the kidneys
    - digoxin, beta-blockers, ACE inhibitors
    - aminoglycoside antibiotics, lithium
    - NSAIDs, H_2-blockers

PHARMACODYNAMICS

- ❑ increased tissue sensitivity to drugs acting on the CNS
- ❑ decreased beta-receptor sensitivity to agonists and antagonists

Optimal Pharmacotherapy

- ❑ be informed of
    - presenting symptoms
    - detailed medication history and allergies
    - patient's financial situation/drug benefit coverage
    - patient's views on taking medication
    - history of dysphagia
- ❑ medication information needed
    - clinical pharmacology and side effects of the drug
- ❑ other principles
    - educate the patient and the caregiver about the medication
    - have a simple treatment regimen
    - prescribe liquid formulations when necessary
    - review medications regularly (discontinue if unnecessary)
    - new symptoms and illnesses may be caused by a drug

ACKNOWLEDGEMENT

Abrams WB, Beers MH, Berkow R. *The Merck Manual for Geriatrics, 1st edn.* Rahway, NJ: Merck and Co. Inc. 1990. Used with permission.