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DEMOGRAPHICS

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>
<thead>
<tr>
<th>Mortality (in descending order)</th>
<th>Morbidity (in descending order)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. heart disease</td>
<td>1. arthritis</td>
</tr>
<tr>
<td>2. malignancy</td>
<td>2. hypertension</td>
</tr>
<tr>
<td>3. stroke</td>
<td>3. hearing impairment</td>
</tr>
<tr>
<td>4. dementia</td>
<td>4. heart disease</td>
</tr>
<tr>
<td>5. COPD</td>
<td>5. visual impairment</td>
</tr>
<tr>
<td>6. pneumonia (usually secondary)</td>
<td></td>
</tr>
<tr>
<td>7. accidents</td>
<td></td>
</tr>
<tr>
<td>8. diabetes mellitus</td>
<td></td>
</tr>
</tbody>
</table>

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
AGING CHANGES IN BODY SYSTEMS . . . CONT.

- 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

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 (increased 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
MUSCULOSKELETAL SYSTEM

Table 2. Musculoskeletal System Changes

<table>
<thead>
<tr>
<th>Decreased</th>
<th>Clinical Manifestations</th>
</tr>
</thead>
<tbody>
<tr>
<td>lean body mass</td>
<td>decreased muscle strength</td>
</tr>
<tr>
<td>myofibrils</td>
<td></td>
</tr>
<tr>
<td>glycolytic oxidative enzyme activity</td>
<td></td>
</tr>
<tr>
<td>bone density</td>
<td>increased risk of osteoporosis, osteoarthritis, degenerative disk disease</td>
</tr>
<tr>
<td>osteoblastic activity (decreased more than osteoclastic activity)</td>
<td></td>
</tr>
<tr>
<td>repair of microfractures</td>
<td></td>
</tr>
<tr>
<td>chondrocyte activity</td>
<td></td>
</tr>
</tbody>
</table>

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
GERIATRIC ASSESSMENT ...

- cardiopulmonary
  - 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 B₁₂, 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
SPECIALIZED GERIATRIC SERVICES

- 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
COMMON MEDICAL PROBLEMS OF THE ELDERLY CONT.

- 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

<table>
<thead>
<tr>
<th>System</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>cardiovascular</td>
<td>MI, arrhythmia, orthostatic hypotension</td>
</tr>
<tr>
<td>neurologic</td>
<td>stroke, TIA, dementia, Parkinson’s, seizures</td>
</tr>
<tr>
<td>gastrointestinal</td>
<td>bleeding, diarrhea</td>
</tr>
<tr>
<td>metabolic</td>
<td>hypoglycemia, anemia, dehydration</td>
</tr>
<tr>
<td>musculoskeletal</td>
<td>myositis, muscle weakness, arthritis</td>
</tr>
<tr>
<td>drug-induced</td>
<td>diuretics, antihypertensives, sedatives</td>
</tr>
<tr>
<td>genitourinary</td>
<td>incontinence, micturition syncope</td>
</tr>
<tr>
<td>psychologic</td>
<td>depression, anxiety</td>
</tr>
</tbody>
</table>

**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 B₁₂, ESR
  - urinalysis
  - cardiac enzymes, ECG

**Management**
- multidisciplinary (social work, OT and PT referrals may be required)
- treat underlying cause(s) and any known complications
COMMON MEDICAL PROBLEMS OF THE ELDERLY... CONT.

- 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
COMMON MEDICAL PROBLEMS OF THE ELDERLY... CONT.

- 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
COMMON MEDICAL PROBLEMS OF THE ELDERLY ...CONT.

- 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
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, H₂-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