Geriatric Gait Assessment

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Epidemiology

- 1 in 10 elderly have difficulty walking
- 20-25% >80 yo use mechanical gait aid
- 2/3 hospitalized elderly >75 yo have decline in mobility; at discharge, 2/3 of those pts not improved, 1/10 worse

Age-related gait changes

- Normal gait: toe off, swing phase, heel strike; only 25% time supported on both feet
- In healthy elderly, abnormal gait more prevalent with advancing age
- Often multifactor (75%); when single cause, musculoskeletal is most common

Case 1

- 68 yo with history of hypertension, admitted for decreased ambulation, increased falls, urinary incontinence
- On exam, mental status 22/30, hyperreflexia L>R and Babinski sign on left; bilateral grasp reflexes; despite excellent strength, can’t stand alone

Neurological Gait Disorders

- Peripheral neuropathy : distal sensory and motor signs only
- Lumbosacral: lesion below end of spinal cord (T12) = no upper motor neuron signs
- Cervical: upper motor signs: no cranial nerve or gray matter signs (e.g., dementia)
- Brain: cr n and gray matter signs, EPS

Upper motor neuron signs

- Weakness (not complete paralysis) of a group of muscles (not a single muscle); minimal muscle atrophy
- “Clasp-knife” spasticity
- Hyperreflexia (+/- clonus)
- Spread of reflexes
- Babinski response

Central Gait Disorders

- Slow, wide-based, shuffling, small-stepped, “magnetic,” difficulty turning
- When severe, truncal instability and can’t initiate a step; can’t stand without support; often few focal signs
- Most pts also have impaired cognition
- Differential Dx: “multi-infarct,” NPH, Subdural hematoma

Case 1: Management

- CT or MRI if recent worsening or candidate for shunt (NPH) or subdural drainage
- Review & reduce medications
- Consider trial of physical therapy (caveat: poor sitting balance is poor prognostic sign)

Cerebrovascular Disease

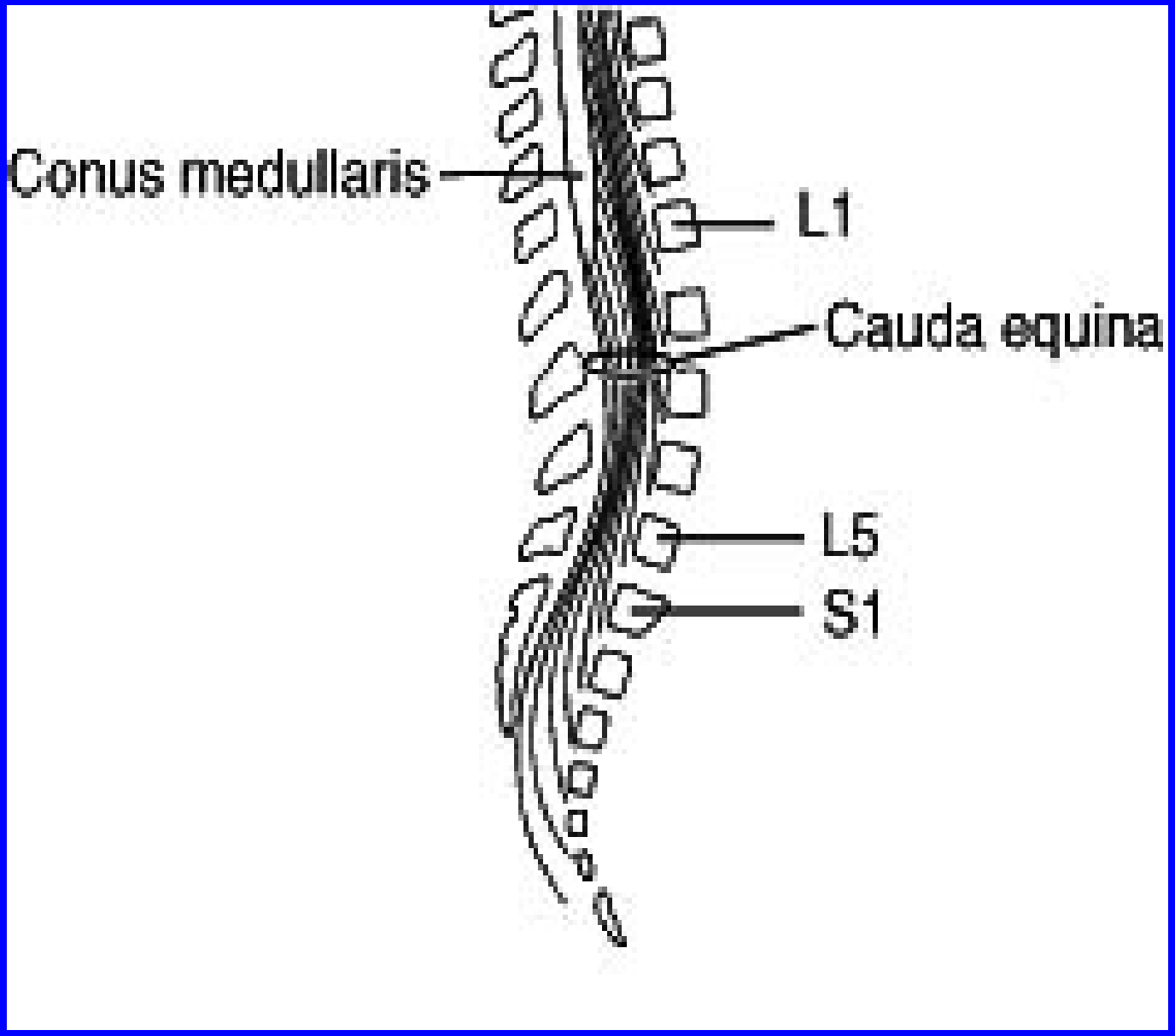
- Vascular dementia often associated with gait disorder at onset of dementia
- Frontal release signs (palmomental, grasp, glabellar) associated with increased falls
- Patients with lacunar infarct may present with falls (due to subtle hemiparesis)
- Refer to physical therapist for cane or walker; ankle-foot orthosis for foot drop

Dementia

- Best evidence for reducing falls is removal of medication that contributes to cognitive impairment
- Make caregiver aware that cognitive deficits increase risk of falls
- Offer assistive device that avoids new learning (rolling walker easier than cane or four-legged walker)
- Reduce environmental hazards

Case 2

- 80 year complains of increased falls. Falls more likely when getting up to bathroom at night. Minimal neck discomfort.
- Mental status normal. Stiff-legged gait. Romberg +. Upper and lower extremity increased tone and hyperreflexia; mild bilateral lower ext weakness. Position sense impaired.


Conus medullaris
L1
Cauda equina
L5
S1

Cervical Myelopathy

- Cervical myelopathy usually due to degenerative spine changes; may have little neck pain & no radicular symptoms
- Upper motor neuron signs often present
- Paresthesias and loss of position sensation may be caused by cervical myelopathy but may also have peripheral neuropathy

Cervical Spine Surgery

- Small trials do not provide reliable evidence of effectiveness of surgery
- Better response to surgery if shorter duration, milder symptoms (better if not walker dependent pre-op)
- Long term follow up suggests many maintain improved gait, reduced fall risk
- Collar & non-surgical approach; outcome similar to surgery if sx > 2yr

B12 deficiency and gait

- B12 deficiency associated with diminished proprioception and ataxia in adults; CBC may be normal
- Improvement within 2-3 mos of B12 Rx if any improvement at all
- Reversibility depends on severity and duration

Case 2: Management

- Image neck (MRI) if candidate for surgery
- Check B12, TSH, glucose

Case 3

- 74 year old man complains of exertional pain in back of thighs that limits walking; pain is worse walking downhill than uphill; some relief with rest and leaning forward
- On exam, patient has normal cranial nerves, DTRs and upper extremity strength; mild weakness of quadriceps bilaterally

Management of Lumbar Stenosis

- Pain greater than neurological findings
- Surgery may reduce pain/improve walking distance but residual disability post op is common
- Surgery may be postponed or avoided if walking disability mild (walking capacity improved in 42%, unchanged 32%, worse 26%)

Case 4

- 82 yo retired professor brought by daughter complaining of increased difficulty walking. History of alcoholism, “no drink in years.” Takes Librium for sleep.
- On exam, patient annoyed, refuses mental status test. Motor strength normal. Heel/shin, finger/nose WNL. Stance wide-based, eyes on feet. Shuffles turns.

Cerebellar Disorders

- Most often, vascular or alcohol-related
- Truncal ataxia without limb dysmetria often seen with atrophy or infarction of vermis
- Individual muscle strength normal, tone normal; finger to nose, heel to shin often ok
- Benzodiazepines worsen gait; 28-fold increase in fall risk!

Alcohol and Gait Disorders

- Severity of gait disorder related to duration and quantity of alcohol consumption
- Peripheral neuropathy and cerebellar degeneration may occur independently or simultaneously
- Both gait & neuropathy may improve with abstinence

Other causes of gait disorders

- Visual impairment increases risk for falls and fracture; greatest risk when depth perception impaired (I.e., one good eye, one bad eye; relative risk 2.0 to 6.0)
- Drugs worsen gait disorder (benzos, SSRIs, tricyclics, antipsychotics, anticonvulsants); list similar to those causing cognitive change

Take Home Points: Gait Disorders

- Upper motor neuron signs = lesion above T12
- Central CNS lesions cause ***axial instability*** *with few focal neurological signs*
- Drugs, drugs, drugs

Case 5

- An 80 yo man is referred for evaluation of “Depression, Ritalin candidate?”
- Meds: Hctz, lisinopril, Reglan
- On exam, flat affect, immobile. Repeated attempts to stand unsuccessful. With help, stands and takes a few narrow-based, short steps, then freezes.

Prevalence of Parkinsonism

- Accounts for 10% of gait disorders
- Community elderly >65; Gait abn & 1or more signs of parkinsonism:

15%	65-74 yo
30%	75-84 yo
50%	> 85 yo

Differential diagnosis

- Idiopathic Parkinson's Disease 85%
- Drug-induced (e.g. Reglan) 7-9%
- Parkinson-plus syndromes 4%
- Vascular parkinsonism 3%
- Resting tremor, asymmetric rigidity/tremor, and response to Levodopa best predict correct diagnosis of PD

Clinical Features

- Tremor
- Rigidity
- Bradykinesia
- Gait disorder
- (Also, blunted postural reflexes and autonomic dysfunction)

Parkinsonism

- Rule out drug-induced parkinsonism
- Sinemet is most effective medication for improving gait and balance in PD
- Rolling walker is usually most appropriate assistive device
- Exercise may improve balance & gait
- Avoid carrying items in arms (worsens gait and increases fall risk)

Case 5: Management

- Discontinue metoclopramide
- If gait disorder persists, begin carbidopa/levodopa 25/100 bid or tid
- Gradually increase carbidopa/levodopa; goal is at least 75 mg/day of carbidopa

Medications for PD

- Anticholinergics (e.g., Artane, Cogentin)
- Amantadine (Symmetrel)
- MAO Inhibitor (Eldepryl, Azilect)
- Carbidopa/L-dopa (Sinemet)
- Dopamine agonists (e.g., Parlodel, Permax, etc.)
- COMT inhibitors (e.g., Comtan)

When to start drug Rx?

- Functional decline: dominant side more affected, interference with ADLs and gait

Why delay drug treatment?

- Medications often associated with side effects in elderly
- cost of medication is high

Carbidopa/levodopa (Sinemet)

- Most effective med for gait (bradykinesia, rigidity); tremor response variable
- Carbidopa prevents peripheral breakdown of levodopa; > 75 mg daily for max effect
- Begin 25/100 bid or tid; may switch to 10/100 or 25/250 as dose increased; avg patient needs @ 500 to 1000mg L-dopa/day
- Avoid taking with food

Sinemet CR

- Controlled release tablet has delayed onset and longer duration (25/100 or 50/200)
- May reduce dosing frequency by 1/3
- Only 80% absorbed (total dose higher); taken with food improves absorption
- Twice the cost of generic carbidopa/L-dopa
- Useful at bedtime for better overnight control

Anticholinergics
(e.g., Artane, Cogentin, Akineton)

- Limited benefit for tremor, rigidity and bradykinesia
- Common and disabling side effects (constipation, dry mouth, urinary retention, confusion, etc.)
- DON’T USE IN THE ELDERLY

Amantadine (Symmetrel)

- Modestly improves tremor, bradykinesia and rigidity
- Mechanism of action uncertain
- Limited efficacy as disease progresses (100 to 200 mg daily)
- Toxicity includes confusion, psychosis
- May reduce L-dopa induced dyskinesia

MAO Inhibitors: Selegiline (Eldepryl)

- Monoamine Oxidase Inhibitor (MAOI) inhibits breakdown of dopamine
- Minimal symptomatic benefit alone
- Early studies suggest delayed progress of PD (5mg bid); benefit wanes
- May smooth effect of Sinemet
- Risk of serotonin syndrome with SSRI

Rasagiline (Azilect)

- MAO B inhibitor FDA approved in May 2006
- Advantage over selegiline uncertain (may have slightly better efficacy when used alone)
- Dose 0.5 to 1 mg daily
- Over $250 per month

Dopamine Agonists

- Dopamine agonists given alone may reduce PD signs
- Probably less effective than Sinemet
- “Levodopa sparing”; delay dyskinesias
- May also improve response if combined with carbidopa/L-dopa
- Few comparisons between DAs; expensive

Dosing Dopamine Agonists

- bromocriptine (Parlodel): begin 1.25 bid; goal is 20-25mg/d in divided doses
- pergolide (Permax): (no longer available)
- pramipexole (Mirapex): begin .125 tid; goal is 4.5 mg/d in divided doses
- ropinirole (Requip): begin 0.25tid; goal is 24 mg/d in divided doses

Rotigotine (Neupro)

- Transdermal dopamine agonist FDA approved in May 2007
- Only published trials to date compare to placebo
- Side effect profile (e.g., dizziness, nausea) similar to other dopamine agonists
- Advantage over oral DAs uncertain

COMT Inhibitors

- May smooth response to Sinemet
- Entacapone (Comtan): 200 mg with each dose of Sinemet
- Reduce Sinemet 10-15% to avoid levodopa toxicity (dyskinesia, etc.)

Cost

- Carbidopa/L-dopa 25/100 tid $40/mo
- Sinemet CR 50/200 bid @$81/mo
- Trihexyphenidyl 2mg tid $9/mo
- Amantadine 100mg bid @$19/mo
- Eldepryl 5mg bid $29/mo
- Mirapex 1mg tid $177/mo
- Comtan 200mg qid @$204/mo

5 take-home points for PD

- Carbidopa/levodopa (Sinemet) is best; carbidopa > 75 mg daily
- Avoid regular Sinemet with food
- Avoid anticholinergics, Eldepryl, amantadine
- Dopamine agonists may be added
- COMT inhibitors expensive

Case 6

- Ms Lotta Downs is 86 yo and living in two story home. Med problems include DJD, COPD, dementia, depression, macular degeneration, hypertension. Meds same for years; Cardizem, HCTZ, Minipress, Elavil, digoxin. Falls began after daughter moved in with her 2 months ago. Daughter also notes more forgetfulness.

Epidemiology & Cost of Falls

- >Over 1/3 of persons >65 yo fall each year and half have recurrent falls
- <1/10 falls result in fractures
- 1/5 require medical attention
- 8% >70 yo go to ER annually for fall-related injury; 1/3 admitted, avg 8 day stay
- In 1989, >$53 million of Medicare expense in Washington state hospitals due to falls

Morbidity of Falls

- Study of 1100 community dwellers >70 yo for three years showed fallers had decline in ADLs and IADLs
- A single, non-injurious fall triples risk of long-term admission to nursing homes
- Two or more non-injurious falls associated with decline in social and physical activity and >5 fold risk of nursing home admit

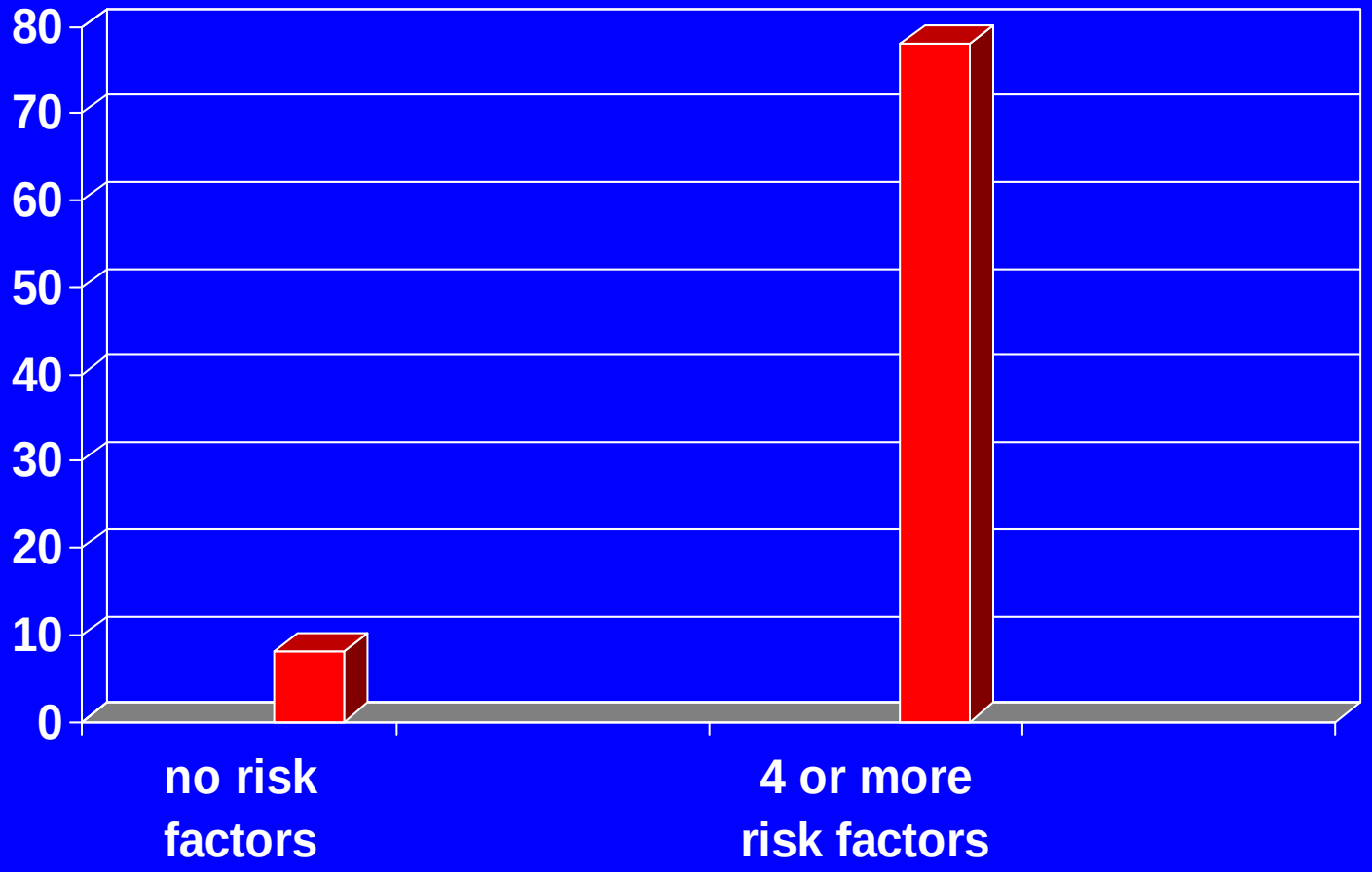
Do elderly folks worry about falls?

- 80% of older women preferred death to a “bad” hip fracture resulting in nursing home admission

Modifiable risk factors

- Arthritis
- Depression
- Orthostasis
- Impaired cognition
- Poor vision
- Impaired balance, gait & muscle strength
- Four or more prescription drugs

Risk of falls in community dwelling Elderly



Strategies to Reduce Falls

- Patient-specific intervention for those at highest risk of falling (e.g., history of falls, recent hospitalization)
- Intervention may be single focus (e.g., home hazard assessment in those with recent hosp discharge) or multifactorial
- Community-based strategy aimed at all elderly, not focused on individuals (reminder: falls occur in 8% without risks)

Single, patient-specific strategies to reduce falls

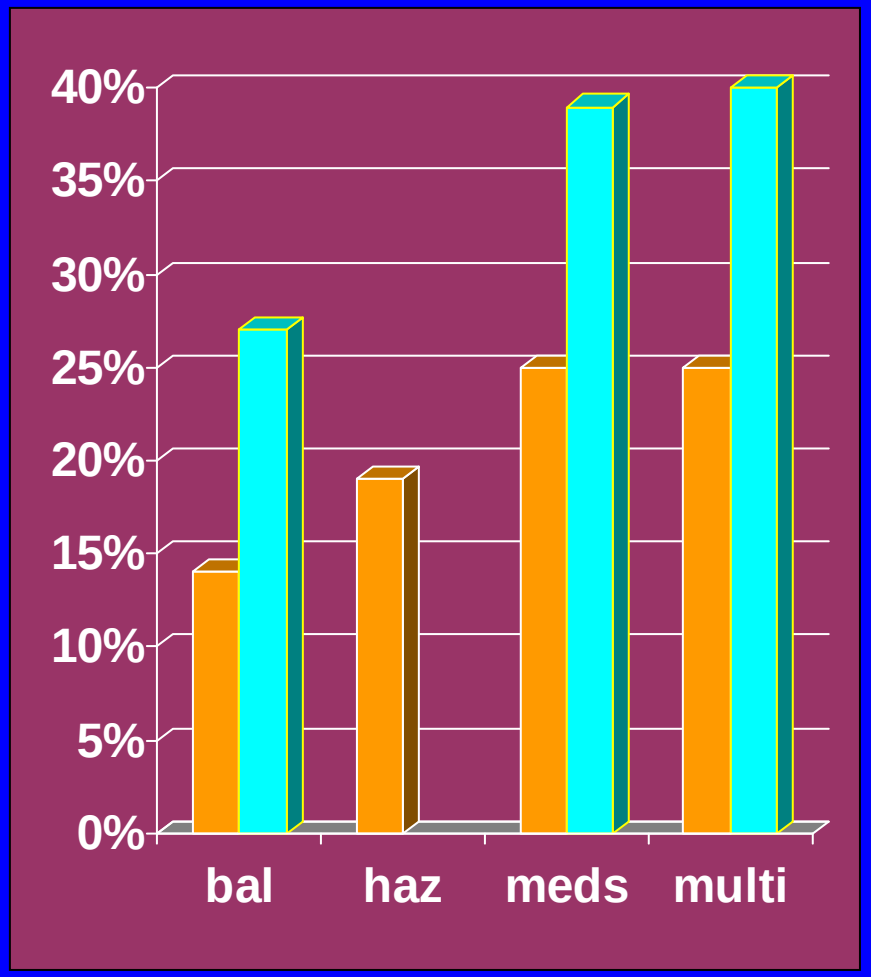
- Professionally supervised balance and gait training and muscle-strengthening exercise
- Hazard reduction: remove rugs, use non-slip bathmats, safer footwear, night lights, add stair rails (25% of falls occur on stairs)
- Taper and discontinue benzodiazepines, antidepressants, sleep medications, neuroleptics

Multifactorial, patient-specific risk assessment

- Multifactorial assessment only successful if linked to interventions targeting specific, identified risks
- Important components: review/reduce meds; balance and gait training; muscle strengthening exercise; identify and treat orthostasis; reduce home hazards; targeted medical and cardiovascular disease assessment and treatment

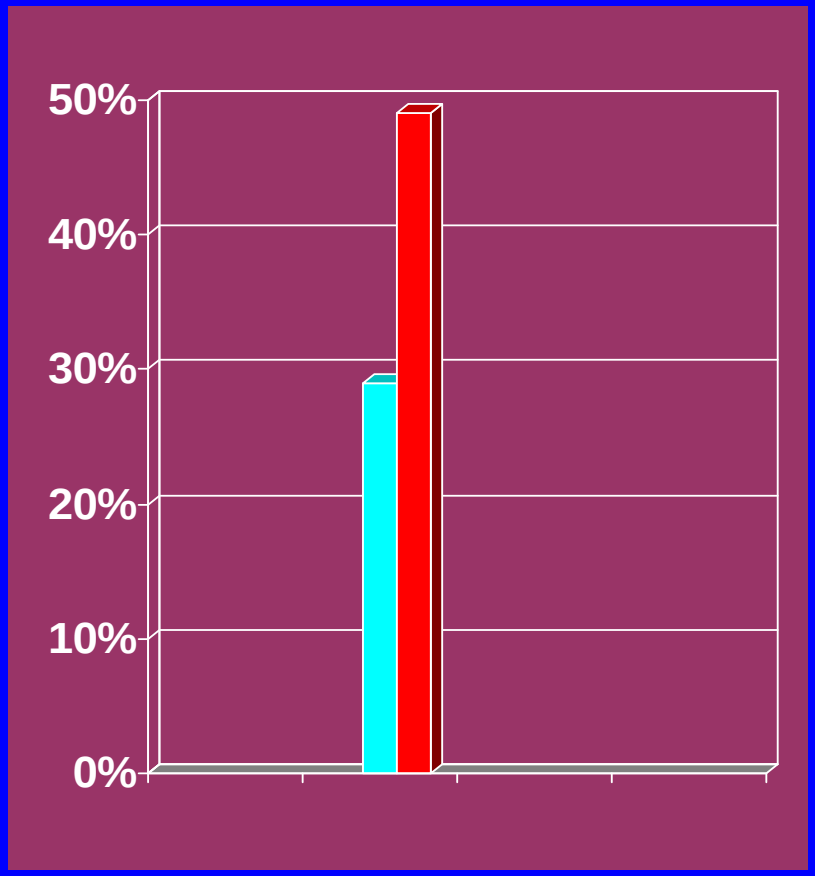
Patient-specific strategies to reduce falls

- Balance/gait/strength training
- Reduce home hazards after hosp
- Discontinue psychotropic meds
- Multifactorial risk asssessment/targeted intervention



Community-based fall prevention

- For healthy elderly who haven't fallen, progressive balance training (e.g., Tai Chi) plus strengthening may reduce fall risk
- Short-term studies; need methods to enhance long term adherence



Hip Protectors

- Seven trial including >3500 patients in nursing homes or frail elderly at home
- Hip fractures: 2.2% assigned to hip protectors vs 6.2% controls despite similar fall rates (NNT=25)
- Long term compliance poor (25-50%; skin irritation, uncomfortable, too warm)
- HIP PRO: 1-sided protectors; no difference in hip fractures protected vs unprotected side (Kiel et al, JAMA 298: 413, 2007)

Syncope

- Syncope associated with a minority of falls
- Like falls, multiple diagnostic tests rarely yield clear cause of syncope
- Preliminary data suggests that patients who have recurrent unexplained falls and bradycardia in response to carotid sinus stimulation may have fewer falls with cardiac pacemaker

Orthostasis

- Significant postural hypotension detected in 20% of men and women >65 yo in Cardiovascular Health Study
- Only 2% reported dizziness; symptoms often nonspecific (e.g., falls due to knee buckling)
- Postprandial hypotension occurs in 1/3 of nursing home patients

Nonpharmacologic treatment of orthostasis

- Volume repletion if dehydrated
- Increased salt and water intake
- Sleep with head of bed raised
- Custom-fitted elastic stockings
- Exercise
- Avoid large meals, low carbo diet, sit for one hour postprandial, avoid Etoh

Pharmacologic Treatment of orthostasis

- Fludrocortisone (Florinef) 0.1-0.5 mg daily (1/3 of elderly will stop due to supine hypertension, edema, chf)
- Pseudoephedrine 30-60 mg tid
- Midrodine (Proamatine) 10 mg tid
- NSAIDs, caffeine
- Erythropoietin if anemic and low epo level
- Combination of measures may be needed

Treatment strategies for specific medical conditions

- Identify and manage visual impairment
- Identify and manage neurological disorders
- Identify and manage musculoskeletal disorders (osteoarthritis, osteoporosis)
- Identify and manage orthostasis
- Identify and manage syncope

Visual Loss and Fall Risk

- 18% Hip fractures secondary to poor vision

ACUITY	RISK OF FALL
20/30-20/70	1.5X
>20/100	2.2X
ONE GOOD EYE	1.9X

Case 6

- Multifactorial assessment warranted
- Likely victim of ‘enforced compliance’; ADRs cause orthostasis, falls and worsening memory; d/c Elavil, HCTZ, digoxin, Minipress; ? Cardizem
- Home assessment for hazards; reduce need to use stairs; Tai Chi?
- Pain control, exercise, hip protectors, osteoporosis Rx, better shoes

Key References

- Alexander N. Gait disorders in older adults. J Am Geriatr 44:434, 1996.
- Lang AE et al. Parkinson's Disease. N Engl J Med 339:1044-53, 1130-43, 1998.