Case #1

81-year-old woman

- February 2008:
  - 3 years of gradually progressive gait imbalance
  - no vertigo, dizziness or paresthesias
  - etiology unclear on examination
  - MRI scans of the brain, cervical spine and eventually lumbar spine were non-diagnostic.

- Video of history and gait at UCSF

Exam:

- old absent right ankle jerk
- vibration was absent (toes), mildly decreased (ankles)
- proprioception mild to moderately decreased at her toes
- Romberg immediately after standing only mildly unsteady
- unable to tandem; usual gait some initial freezing, then mild-moderately increased base
Question #1

The most likely mechanism contributing to the bulk of her incapacitation is which of the following:

A. gait apraxia  
B. gait ataxia  
C. higher level gait disorder  
D. primary progressive freezing gait  
E. tremor

Question #2

After the neurologist’s interview and exam, the most efficient next diagnostic study would be most likely to occur in the:

A. Clinical lab  
B. EEG lab  
C. EMG lab  
D. Neuroradiology suite  
E. Sleep lab

Evolution of a concept: Apraxia/higher level gait disorder

ataxia v. apraxia  
gait = limb apraxia  
low, middle, high gait disturbance levels  
gait apraxia v. leg apraxia  
Cortico-basal ganglia-thalamo-cortical loop

Higher level gait disturbances

- vary with environment and emotions (vs. predictability of lower level gait disorders)
- more complex than limb apraxia
- categorization:
  - “Inappropriate bizarre postural synergies or foot placement”
  - “Subcortical disequilibrium”
  - “Frontal disequilibrium”
  - “Frontal gait disorder”

Elble “Gait and dementia: moving beyond the notion of gait apraxia”  
Freezing Gait: sudden transient block in ambulation

- **Secondary:**
  - common in late Parkinson’s disease
  - also variety of neurodegenerative disorders:
    - PSP
    - MSA
    - CBD
    - “vascular parkinsonism”
    - NPH

- **Primary Progressive Freezing Gait**
  - initially small steps, then affects turning
  - falls 3-10 years after onset; wheelchair within 5 years in most
  - gradually progressive bradykinesia
  - No clear evolution into PD


Oscillations may be:
- a) alternating with agonist and antagonist firing one after the other
- b) synchronous with them firing simultaneously

Physiologic mechanisms of tremor
- mechanical at resonant frequency
- reflex gain and conduction time
- central neuronal pacemakers
- unstable feed-forward or feed-backward loops


Physiologic mechanisms of tremor
- central neuronal pacemakers
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rhythmic oscillation manifests as tremor frequency

orthostatic tremor
- Unique clinically
- ...can walk but not stand
- ...high frequency 16 Hz (13-18)
Case #2

74-year-old man with knee buckling and imbalance

**Patients**
- 10 months: left leg tending to give away
- 12 months: ago bilateral, gradually worsening
- at presentation “10-12 times” good day, “126 times” bad day
- Exercise one day leads to bad day next

**Wife**
- 10 months: imbalance first few hours each a.m. with gait hesitation
- 30+ years: slight tendency of left>right legs to give away when standing still

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Case #2

**Probable vascular disease**
- 2005-2006 3 episodes less responsive with slow speech, ? TIA
- 2007 more prominent episode of slurred speech and right-sided weakness, probably small stroke
- no further episodes but feels his right side fatigues more quickly than the left

**History of sleep apnea but sleeps well 8 hours with CPAP**
- naps easily while reading a book or watching television, but with one nap a day, he feels fairly rested and awake
- does not feel that he could fall asleep driving or in a conversation
- denies vivid dreams, dream enactment, sleep paralysis, illusion or hallucinations as he falls asleep or awakens

**Numbness of both feet for 3-5 years**

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**Exam:**
- reflexes trace except ankles (reinforcement)
- Vibration absent toes, decreased ankles
- Romberg and tandem normal; walked well on toes and heels
- **Gait normal** with mildly increased base, good associated movements, normal ignition and step size, no buckling
- **Standing still:**
  - 5 or 6 subtle momentary give-away jerk-like movements
  - left leg start to buckle at knee, brief loss muscle tone
  - Duration < 1 second, no falls
Question #3

The most likely mechanism contributing to his leg buckling is:

- A. cataplexy
- B. epilepsy
- C. myoclonus
- D. narcolepsy
- E. tremor

**Cataplexy**
- Most often dramatic
  - General loss of tone lasting seconds
  - Can be partial
- Almost always emotional trigger
- Most often with narcolepsy syndrome
  - 64-75% of narcolepsy patients have some cataplexy
  - Sudden loss of tone + automatic behaviors (somnolence) can be mistaken for partial seizures

**Myoclonus**
- brief, lightening-like, muscle jerks (EMG bursts 10-50ms, rarely >100ms)
- Phenomenon, not disease
  - Physiologic (hiccups, startle)
- Hereditary and isolated
  - Hyperkplexia
  - Essential myoclonus (1st-2nd decade, responsive to alcohol)
- Hereditary with seizures = progressive myoclonic epilepsies
  - Ataxia + cognitive decline
- Myoclonus without epilepsy
  - With cortical, subcortical and basal ganglia degenerative diseases
  - Post-hypoxic
  - Metabolic (exogenous/endogenous)

**Orthostatic myoclonus**
- 15 patients with myoclonus in leg muscles on standing only (or a marked increase on standing)
- 12/15 had some underlying central neurologic process
- Gait often looked like ignition failure or ‘apraxia’
- Gait declined gradually over 3-14 years; sudden falls in 25%
- Leg tremulousness noted by patient or physician in 13/15
- Orthostatic tremor was the referral diagnosis in 8/15

Glass, Ahlskog, Matsumoto
"Orthostatic myoclonus: A contributor to gait decline in selected elderly"
Orthostatic Myoclonus

Glass, Ahlskog, Matsumoto
“Orthostatic myoclonus: A contributor to gait decline in selected elderly” Neurology 68: 1826-1830 (2007)

- Less common than orthostatic tremor
- Usually a secondary syndrome, whereas orthostatic tremor usually is primary
- More likely to respond to medications (levitiracetum, clonazepam, valproate)

Outcome:

Patient #1 Orthostatic tremor
unchanged over nearly 2.5 years
- No benefit from Sinemet, pramipexole, clonazepam or gabapentin
- Levetiracetam possibly in future

Patient #2 Orthostatic myoclonus
improved (126 → 10-15 episodes on bad day)
on levetiracetam 750 mg bid