Aging, Medications and Dysphagia
West Virginia Speech Language and Hearing Association Annual Conference, Bridgeport WV April, 2016

Disclosure

• University of Pittsburgh (salary)
• WVSHA honorarium
• NIH RO-1 (25% effort)
• No products
• Lots of biases favoring my patients

Prevalence of dysphagia by age

Altman et al., 2010. (raw data from National Hospital Discharge Summary, 2004-2005)
Most common dysphagia-related diagnoses

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>% with dysphagia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluid and electrolyte disorder (266)</td>
<td>17.5%</td>
</tr>
<tr>
<td>Diseases of the esophagus (530)</td>
<td>15.1%</td>
</tr>
<tr>
<td>Ischemic Stroke (433-434, 436, 437.0, 437.2)</td>
<td>14.8%</td>
</tr>
<tr>
<td>Aspiration pneumonia (507)</td>
<td>12.0%</td>
</tr>
<tr>
<td>Urinary tract infection (599.0)</td>
<td>10.4%</td>
</tr>
<tr>
<td>Congestive heart failure (428.0, 2.9)</td>
<td>10.1%</td>
</tr>
<tr>
<td>Pneumonia NOS (480-487)</td>
<td>8.1%</td>
</tr>
<tr>
<td>Coronary atherosclerosis (414)</td>
<td>7.3%</td>
</tr>
<tr>
<td>Parkinson’s Disease (332.0-332.1)</td>
<td>4.6%</td>
</tr>
<tr>
<td>Alzheimer disease (331.0)</td>
<td>4.6%</td>
</tr>
</tbody>
</table>

Account for >1/2 of all Dysphagia-related hospitalizations

Altman et al., 2010: National Hospital Discharge Summary

Increased risk of mortality in patients with dysphagia

<table>
<thead>
<tr>
<th>Dysphagia-related diagnosis</th>
<th>Relative Risk of death</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of rehabilitation procedure</td>
<td>13.7*</td>
</tr>
<tr>
<td>Coronary atherosclerosis</td>
<td>2.6**</td>
</tr>
<tr>
<td>Acute &amp; chronic respiratory failure</td>
<td>0.9**</td>
</tr>
<tr>
<td>Aspiration pneumonia</td>
<td>0.9*</td>
</tr>
<tr>
<td>Hemorrhagic stroke</td>
<td>0.1*</td>
</tr>
<tr>
<td>Septicemia</td>
<td>0.5***</td>
</tr>
<tr>
<td>Coronary atherosclerosis (414)</td>
<td>2.6</td>
</tr>
<tr>
<td>Parkinson’s Disease (332.0-332.1)</td>
<td>1.1</td>
</tr>
<tr>
<td>Alzheimer disease (331.0)</td>
<td>1.1</td>
</tr>
</tbody>
</table>

Relative Risk: Patients with the disease AND DYSPHAGIA are x times more likely to die than patients WITHOUT DYSPHAGIA

* p < .001
** p < .01
*** p < .05

Homeostasis

- Maintenance of a constant, stable condition
- Organ systems maintain homeostatic equity
- Baseline
  - Few resources used to maintain homeostasis
- Examples
  - Digestion, fluid/electrolyte balance (hydration)
  - Temperature regulation, cardiovascular functions
Homeostenosis

- The characteristic, progressive constriction of homeostatic reserve that occurs with aging in every organ system.
- With aging, physiologic reserves are increasingly used to maintain homeostasis
  - Declining reserves left for meeting new challenges

Homeostenosis

More reserve for emergency → Less reserve for emergency

Available reserve for WHEN WE NEED IT

Start functional

Amount of reserve used to maintain homeostasis

Young → Age → Old

Homeostenosis

More reserve for emergency → Less reserve for emergency

Available reserve for WHEN WE NEED IT

Start functional

Amount of reserve used to maintain homeostasis

Young → Age → Old

Disease

RESERVE DEPLETED
Brain & Nervous System

- Physiologic changes:
  - Axonal degeneration (fewer neurons)
  - Apoptosis
  - Synaptic decline in some regions, growth in others
  - Atherosclerosis, diminished perfusion
  - Declining acetylcholine, dopamine production
  - Slowed conduction velocity

Halter et al., 2009; Lauretani, et al., 2006
Cognition

![Mean MMSE (9-12 years education)]

- Data from: Crum et al., 1993

Musculoskeletal system

- Reduced muscle mass
  - Sarcopenia
  - Vascular, mitochondrial changes; oxidative stress
- Reduced strength

![Calf muscle mass (mg/cm³)]

- Male:
  - 20 years old: 64 mg/cm³
  - 80 years old: 68 mg/cm³
- Female:
  - 20 years old: 66 mg/cm³
  - 80 years old: 70 mg/cm³

Halter et al., 2009; Lauretani, et al., 2006
Digestive System

- Symptoms in healthy aging subjects
  - Diminished esophageal motility
  - Gastroesophageal reflux
    - 35% heartburn, regurgitation, chest pain, dysphagia
  - Incompetence of GE junction
  - Decreased gastric clearance
  - Colonic problems

Halter et al., 2009

Risks for dysphagia in elderly

- Hospitalized patients
  - Pulmonary, renal disease, diabetic neuropathy
  - CHF
  - Primary neurological diagnosis
  - Inadequate oral hygiene
  - Altered mental status

Iatrogenic conditions in the elderly

- Hospitalization
  - 5 times risk of contracting iatrogenic conditions
  - 35% chance of functional decline
- Conditions that predispose to more illness
  - Added medications
  - Delirium
  - Sleep deprivation
  - Malnutrition and dehydration

Halter et al., 2009
Iatrogenic conditions in the elderly

- Nosocomial infections
  - Pneumonia, UTI
  - C. difficile diarrhea
- Gastric colonization
  - In scenario of increased GE reflux
- Safety issues

Halter et al., 2009

Iatrogenic risk factors in aging

- Postoperative sensorimotor impairments
- Predispose to dysphagia
  - Anterior cervical fusion*
  - Hardware issues
  - Thyroidectomy, carotid endarterectomy
    - Laryngeal nerves (thyroid)
    - Vagus itself (CEA)

*Krislovich, et al., 2000

Iatrogenic risk factors in aging

- Postoperative sensorimotor impairments
  - Predispose to dysphagia
    - Esophagectomy**
      - Vagus, phrenic n. injuries
    - Aortic root, arch, valve repairs
      - Recurrent laryngeal nerve (left)
    - Coronary artery bypass grafting
      - On pump vs. off pump

**Atkins, et al., 2007
Other iatrogenic risk factors in aging

- Airway manipulation
  - Mechanical ventilation
  - Endotracheal intubation
  - Tracheostomy
- Post-anesthesia clearance
  - Medication elimination half life
- Medication side effects

Swallowing changes with aging

- Reduced propulsive forces
- Later onset of pharyngeal activity
  - Airway closure
- Cricopharyngeal noncompliance
- Diminished sensory function
  - Oral → pharyngeal uncoupling
  - Reduced cricopharyngeal compliance

What do these changes mean?

- What is “normal” is different
  - “Norms” are historically “young” norms
  - Aging patients have different baselines
- Disease is a greater disruptor
- Patient has less available reserve
- Aging interaction with disease
  - Age related change are normal
  - Disease related change is treatable
  - The ultimate goal is the baseline...
    - Which is the patient with age related changes
• Aging adds unique risks to all systems
• Its effects should be apportioned along with
  • Disease effects
  • Iatrogenic effects
  • Etc.
• And... we are all going to be there some day...
  • What would we do if the patient was us?

Medications and their effects

Medications Affecting Swallowing
• What to look for?
  • Indications
  • Mechanism of action
  • Side effects (adverse effects)
  • Elimination half-life
• Use a good pharma database
  • Micromedex ®
  • Epocrates ®
Elimination half-life

- The duration required for clearance of one-half of the drug from the body
  - Target organ
    - Liver, kidney primarily

Elimination half-life

- Long half-life (6 hours), 1 dose
- Short half-life (1 hour), Dosage, q 6h

Elimination half-life

- Short half-life
- Long half-life - accumulation

(c) 2016 James L Coyle except as otherwise attributed
Mental Status Changes

- EtoH
- Antianxiety (benzo.s-) (Ativan, Xanax)
- Anticholinergics (Benadryl)
- Antiepileptic (Dilantin, Tegretol, Klonopin)
- Antidepressants (tricyclics, SSRI’s)
- Antiemetics (metaclop. compazine)
- Antihistamines (beta blockers)

More →

Mental Status Changes

- Antiparkinson (amantadine, bromocriptine)
- Antipsychotics (thorazine, haloperidol)
- Antitussives (codeine, dilaudid)
- Cardiac (Lanoxin)
- Decongestant (ephadrine, pseudo-)
- H2 antagonist (Zantac, Tagamet)
- Hypnotics (barbit., benzo-s.)

More →

Skeletal muscle function

- Muscle relaxants
  - Benzodiazapines, Flexeril
- Narcotic analgesic (opioids)
  - Neuromuscular transmission, CNS activity
### Coordination

- Benzodiazepines, sedatives
  - Aphasia reported
- Tardive dyskinesia
  - Antipsychotics
- Steroid inhalants

### Smooth Muscle Function

- **Inhibitory**
  - Anticholinergic, Tricyclic antidepressant, Calcium channel blockers, Alcohol
- **Excitatory**
  - Cholinergic agonists (Ach-esterase inhibitors, etc.)

### Decrease LES resting pressure

- Cholecystokinin, sekretin, progesterone, glucagon, neurotensin, dopamine, atropine, butylscopolamine, theophylline, nitrates, alcohol, fat, chocolate
- Barbiturate, cigarettes, benzo., Ca channel blockers (cardizem), caffeine, anticholinergics
Increase LES resting pressure

- Antacids (tums)
- Beta blockers (stimulate Ach release)
- Cholinergics (mimics acetylcholine)
- Prokinetics (increase Ach release)
- May worsen symptoms

Xerostomia

- Anticholinergics, some antiemetics, antihypertensives (clonidine, reserpine), ACE inhibitors, some antihistamines, diuretics, opiates, antipsychotics

Medications Affecting Swallowing

- Mechanical Dysphagia
  - Largely oral medications producing esophageal ulceration
  - Enteric coated tablets
  - Prokinetics
    - Increase LES resting pressure
- Neurogenic Dysphagia
  - Antipsychotics, botulinum toxin
Esophageal Injury

- Bedtime medications, insufficient fluid with pills, supine position, size of pills, left atrial enlargement, thoracic surgery, advanced aging, esophageal motility disorders

Mimicking signs: Cough

- Angiotensin converting enzyme (ACE) inhibitors
  - Produce unexplained cough in up to 20% of users
  - Increases substance P production

  - Trials under way to determine value in pneumonia prevention

Anorexia

- Chemotherapeutic agents, digitalis, fluoxetine, iron suppl., stimulants, decongestants, NSAID, K, SSRI, narcotic

- Loss of Taste

- Metallic Taste
Others

- NMJ Blockade (paralytics)
  - Botulinum toxin
  - Atracurium (mechanical ventilation)
- Induced myopathy (corticosteroids)
- Induced movement disorder (dyskinesia)
- Induced sensory abnormality

Medications-iatrogenic

- Antipsychotics*
  - 60% increase pneumonia risk in a case-control study of elderly patients
    - Risk in first week of treatment: 450% increase
    - Subsides (does not disappear) over time
    - Most events with atypical antipsychotics
      - Clozapine, Abilify, Risperdal
      - Extrapyramidal effects, sedation
    - Typical drugs: sedation (haloperidol, chlorpromazine
  *Knol, et al., 2008

Medications-iatrogenic

- Antipsychotics
  - Significant source of choking in psychiatric hospitals*
  - Movement disorders
    - Tardive dyskinesia → dysphagia
  *Carl & Johnson, 2006
Acid suppression medications

- Aggressive acid suppression may create conditions favoring pathogenesis of pneumonia*
  - PPI: >2 times increase in pneumonia risk, incidence
  - Ambulatory and hospitalized patients
  - H₂ blockers: increased risk (lower risk)
  - Sucralfate (Carafate) substitute

- CDC advisory: PPI and C. difficile

*Marik, 2001; Marik and Dhainaut, 2002; Lijmer et al., 2000; Egi, 2003; Hong et al., 2009

Questions?