**ASPIRATION PNEUMONIA**

- The issue with dysphagia literature is that all pneumonias are considered to be aspiration pneumonia
- This inflates the actual incidence of aspiration pneumonia in study cohorts

DiBardino 2015

---

**ASPIRATION PNEUMONIA**

- "The most common misperception about swallowing treatment is that the primary purpose of intervention is to identify aspiration and that aspiration can and must be prevented. The overwhelming emphasis on the supposed negative effects of aspiration seems to have developed from the early literature on swallowing disorders in which it was repeatedly stated that all aspiration was probably lethal. These early publications relied on the seminal works of Bartlett, Cameron, and others who were writing of the hazards of aspiration of stomach contents including vomitus..."

Campbell-Taylor 2008

---

**ASPIRATION PNEUMONIA**

- It is important to understand that aspiration is a common event that may lie within the spectrum of normal physiology
- One of the most common consequences of aspiration is actually to have no consequence
- The inoculum is cleared by the normal airway and/or parenchymal host defenses without overt clinical syndromes

DiBardino 2015

---

**ASPIRATION**

Aspiration as a Function of Age, Sex, Liquid Type, Bolus Volume, and Bolus Delivery Across the Healthy Adult Life Span Butler 2018

- 203 adults equally distributed between ages 20 and 90
- 6,404 swallows analyzed
- 104 episodes occurred (18% of participants)
- 64% of the aspiration episodes elicited no audible response
- "Many clinicians and researchers have held the presupposition that aspiration (especially silent) is pathologic and use this observation as one of the components to diagnose a swallowing disorder."
- "However, the findings from this large cohort and our previously published, independent smaller cohorts refute this presupposition and introduce a new paradigm of understanding as to what constitutes normal swallowing."

---

**ASPIRATION PREVALENCE**

- Aspiration is a common event. It is estimated to occur in varying degrees in:
  - 18% of normal, healthy individuals (Butler 2018)
  - 45% of healthy normal people during sleep
  - 70% of those with impaired consciousness
  - Up to 40% of those receiving enteral feeding
  - 50-75% of patients with trach tubes

Guilherme, 2003

---

**ASPIRATION PNEUMONIA**

- "The most common misperception about swallowing treatment is that the primary purpose of intervention is to identify aspiration and that aspiration can and must be prevented. The overwhelming emphasis on the supposed negative effects of aspiration seems to have developed from the early literature on swallowing disorders in which it was repeatedly stated that all aspiration was probably lethal. These early publications relied on the seminal works of Bartlett, Cameron, and others who were writing of the hazards of aspiration of stomach contents including vomitus..."

Campbell-Taylor 2008

---

**ASPIRATION PNEUMONIA**

- "The most common misperception about swallowing treatment is that the primary purpose of intervention is to identify aspiration and that aspiration can and must be prevented. The overwhelming emphasis on the supposed negative effects of aspiration seems to have developed from the early literature on swallowing disorders in which it was repeatedly stated that all aspiration was probably lethal. These early publications relied on the seminal works of Bartlett, Cameron, and others who were writing of the hazards of aspiration of stomach contents including vomitus..."

Campbell-Taylor 2008
ASPIRATION PNEUMONIA

- The nasopharynx, oropharynx, lung, and esophagus share a similar microbiome because of chronic micro-aspiration that occurs naturally, which varies by:
  - diet
  - age
  - geographic location

Ferguson 2018

ASPIRATION PNEUMONIA

- "Aspiration Pneumonia" commonly refers to an acute lung infection developing after a large-volume aspiration of oropharyngeal or upper gastrointestinal contents with a high enough pH to avoid chemical pneumonitis (likely pH much greater than 5.5).
- This type of aspiration deposits a large bacterial load of pathogens from the oral cavity or upper gastrointestinal tract into the lungs.
- The possibility of infection with these normally nonvirulent, predominantly anaerobic organisms is partly because of the large amount of material aspirated.
- The challenge in specifically diagnosing aspiration pneumonia is that, for many patients in the community who are at risk for macroaspiration, the events in the days leading up to presentation with fever, cough, and chest radiograph infiltrate are unclear.

DiBardino 2015

ASPIRATION PNEUMONIA

- A common concomitant issue with macroaspiration is decreased mental status.
- This can be the result of CAP rather than the cause.
- Because of this reality, substantial diagnostic overlap exists between aspiration, hospital acquired pneumonia, and community acquired pneumonia.
- Aspiration pneumonia represents 5% to 15% of pneumonias in the hospitalized population.
- The ICD-9 code-based reviews suggest an increasing incidence, making it the second most common diagnosis in Medicare patients who are hospitalized. However, higher reimbursement rates for this ICD-9 code than for CAP ICD-9 codes may falsely increase the frequency in this population.

DiBardino 2015

ASPIRATION PNEUMONIA

- There is no uniform definition for the term "aspiration pneumonia.
- There is no gold standard test to diagnose aspiration pneumonia.
- It has been considered to overlap with other forms of pneumonia.
- The pathophysiology of both aspiration pneumonia and "nonaspiration pneumonia" is identical — microorganisms colonize the oropharynx and nasopharynx and can be microaspirated or macroaspirated.

Ferguson 2018

ASPIRATION PNEUMONIA

- An increased mortality in aspiration pneumonia seems to be a self-fulfilling phenomenon noted by retrospective review as clinicians are more likely to diagnose older, sicker, nursing home patients as having aspiration pneumonia.
- "It should already be self-evident, however, that older, frailer, and more debilitated patients are more likely to die of nearly any infectious disease, pneumonia included."

Ferguson 2018

ASPIRATION PNEUMONIA

- "An attempt to delineate whether it is a 'regular pneumonia' or an aspiration pneumonia on the basis of a speech therapy evaluation is needlessly inaccurate."

Ferguson 2018
Whether or not pneumonia develops from one or more episodes of aspiration depends upon:

- Volume of aspirated material
- Characteristics of aspirate
- Frequency of aspiration
- Integrity of the individual's immune system

Ashford 2005

"However, since other patient characteristics may play equal or greater roles in causing pneumonia, aspiration should not be considered a definitive marker for the patient outcome of pneumonia."


Predictors of Aspiration Pneumonia: How Important is Dysphagia? Langmore 1998

- 189 patients were recruited from outpatient clinics, inpatient acute care medical wards, and a nursing home
- Patients were followed for up to 4 years after comprehensive data collection including clinical and instrumental swallow analyses, dental examination, saliva and throat cultures, medical diagnoses, and functional status
- This prospective outcomes study identified several factors associated with AP

Other key findings

- VF and FEES did not significantly predict AP. Specifically, "Documented aspiration of food or liquid on an instrumental swallow study were not predictors of pneumonia." Only 38% of those who aspirated developed pneumonia.
- Therefore dysphagia by itself does not appear to cause AP. "Dysphagia and aspiration are necessary but not sufficient conditions for development of pneumonia."
- Aspiration of food is much more likely to lead to pneumonia compared to aspiration of liquid
- The development of AP is multifactorial and not simply a function of dysphagia

Predictors of Aspiration Pneumonia in Nursing Home Residents Langmore 2002

- 102,842 Minimum Data Sets (MDS) were analyzed for those who had a diagnosis of aspiration pneumonia
- Logistic regression models indicated all significant predictors of AP
ASPIRATION PNEUMONIA

Rank Order of Predictors of Aspiration Pneumonia in SNF Residents

1. Resident requires suctioning
2. Chronic obstructive pulmonary disease (COPD)
3. Chronic heart failure (CHF)
4. Presence of a feeding tube
5. Bedfast
6. Multiple comorbidities
7. Delirium
8. Weight-loss
9. Dysphagia
10. Urinary tract infections
11. Mechanically altered diet
12. Dependence for eating
13. Bed mobility
14. Locomotion
15. Polypharmacy
16. Advanced age
17. Cerebrovascular accident
18. Tracheostomy

ASPIRATION PNEUMONIA

Predictors of Aspiration Pneumonia in Nursing Home Residents Langmore 2002

Other key findings
- Regarding the presence of a feeding tube, the researchers were unable to determine how much contaminated secretions or refluxed gastric contents played a role.
- Profile of susceptible residents demonstrate the "fragile state" of their ability to clear airway, lungs, and fight off infections.
- Many of the listed risk factors increase bacterial colonization in the oropharynx, therefore increasing the likelihood of developing AP.
- Care givers should use the list to identify high-risk individuals and develop aggressive care plans and respective interventions.

COMPLICATIONS OF DYSPHAGIA

Ashford 2016

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Laryngeal Valve Integrity</th>
<th>Oral Health Status</th>
<th>Predicted Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario 1</td>
<td>Normal</td>
<td>Good</td>
<td>No Aspiration</td>
</tr>
<tr>
<td>Scenario 2</td>
<td>Normal</td>
<td>Good</td>
<td>No Aspiration</td>
</tr>
<tr>
<td>Scenario 3</td>
<td>Normal</td>
<td>Very Poor</td>
<td>Aspiration</td>
</tr>
<tr>
<td>Scenario 4</td>
<td>Elevated</td>
<td>Good</td>
<td>No Aspiration</td>
</tr>
<tr>
<td>Scenario 5</td>
<td>Elevated</td>
<td>Very Poor</td>
<td>No Aspiration</td>
</tr>
<tr>
<td>Scenario 6</td>
<td>Elevated</td>
<td>Very Poor</td>
<td>No Aspiration</td>
</tr>
<tr>
<td>Scenario 7</td>
<td>Elevated</td>
<td>Very Poor</td>
<td>Aspiration</td>
</tr>
</tbody>
</table>

Feinburg 1996

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Laryngeal Valve Integrity</th>
<th>Oral Health Status</th>
<th>Predicted Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Aspiration</td>
<td>1173</td>
<td>7</td>
<td>0.6%</td>
</tr>
<tr>
<td>Minor Aspiration</td>
<td>1493</td>
<td>13</td>
<td>0.9%</td>
</tr>
<tr>
<td>Major Aspiration/Oral feeding</td>
<td>1116</td>
<td>14</td>
<td>1.3%</td>
</tr>
<tr>
<td>Major Aspiration/Artificial feeding</td>
<td>498</td>
<td>22</td>
<td>4.4%</td>
</tr>
<tr>
<td>Total</td>
<td>4280</td>
<td>56</td>
<td>1.3%</td>
</tr>
</tbody>
</table>

Feinburg 1996
<table>
<thead>
<tr>
<th>Final Status</th>
<th>Dyspnea</th>
<th>PNA in pts who expired</th>
<th>PNA considered cause of death</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non aspirators</td>
<td>7 (19%)</td>
<td>5 (71%)</td>
<td>2 (43%) (NS)</td>
</tr>
<tr>
<td>Minor aspirators</td>
<td>9 (24%)</td>
<td>7 (78%)</td>
<td>3 (33%) (NS)</td>
</tr>
<tr>
<td>Major aspirators</td>
<td>21 (49%)</td>
<td>10 (48%)</td>
<td>7 (33%) (NS)</td>
</tr>
<tr>
<td>Artificial feeding</td>
<td>28 (87%)</td>
<td>15 (58%)</td>
<td>14 (54%)</td>
</tr>
<tr>
<td>Total</td>
<td>63 (41%)</td>
<td>37 (59%)</td>
<td>27 (43%)</td>
</tr>
</tbody>
</table>

Source: Feinburg 1996

**COMPLICATIONS OF DYSPHAGIA**

*Recommendations for dietary modification to a nothing by mouth status or modified food consistency had no statistically significant association with development of pulmonary events or survival in patients with detectable or unapparent penetration or aspiration on VFSS compared to full diet recommendations.*

Bock 2018

**ASPIRATION VERSUS PENETRATION**

- Prandial Aspiration: The entry of food or liquid into the lungs.
- Laryngeal Penetration: The entry of secretions, food/liquid, or any foreign material into the laryngeal vestibule above the level of the true vocal folds (i.e., supraglottic area), which are then ejected from the airway. This can occur normally and can also occur before, during, or after the pharyngeal swallow.

Source: Daggett 2006

**ASPIRATION VERSUS PENETRATION**

- Internal branch superior laryngeal nerve supplies sensation to the mucosa from the epiglottis to just above the level of the vocal folds.
- The recurrent laryngeal nerve supplies sensation from the rest of the larynx below the level of the vocal folds.

Source: Ludlow 2015

- The entire motor sequence of swallowing can be readily initiated by stimulating the internal branch of the superior laryngeal nerve (SLN) (Doty 1951; Miller 1972)
- ISLN damage can result in increased occurrence of aspiration (Ding 2015)
- Sensory receptors for triggering cough are likely primarily in the trachea and pulmonary system (below the vocal folds) Ludlow 2015
FEEDING TUBES

• Aspiration can occur one or both:
  • Anterograde: aspiration before and/or during swallowing
  • Retrograde: aspiration from gastroesophageal reflux

• Suspected causes of AP from nasogastric tubes
  • Loss of anatomical integrity of the upper and lower esophageal sphincters due to the presence of the tube
  • Increased relaxation of the lower esophageal sphincter
  • Decreased sensitivity of the pharyngoglottal adduction reflex

• The stomach contains bacteria that cause aspiration pneumonia. The bacteria move into the pharynx from reflux and/or esophageal migration, colonize, and contaminate aspirated secretions.

FEEDING TUBES

• Pilot Study of 12-Month Outcomes of Nursing Home Patients with Aspiration on Videofluoroscopy Croghan 1994
  • Frequently, aspiration is considered an indication for tube feeding (via NG or PEG)
  • Patients with aspiration on videofluoroscopy (VF) are much more likely to receive a feeding tube compared to those who do not demonstrate aspiration
  • Patients with aspiration on VF who are tube fed have higher rates of AP than those who aspirate on VF but do not receive a feeding tube
  • Those with feeding tubes are more likely to be hospitalized
  • Patients with NG tubes have a higher death rate

FEEDING TUBES

  • Retrospective review of 536 patients
  • Conclusions
  • Dysphagia was not identified as a significant predictor of AP
  • Being NPO or having an NG tube was significantly associated with AP as refluxed gastric contents were aspirated

FEEDING TUBES

A comparison of survival, pneumonia, and hospitalization in patients with advanced dementia and dysphagia receiving either oral or enteral nutrition Cintra 2014
  • Observational study of 36 orally fed and 31 tube fed individuals
  • Greater rate of AP and higher percentage of death in tube fed patients

FEEDING TUBES

• There are currently no published randomized trials that compare tube feeding with oral feeding.
• There is no data to suggest that tube feeding improves any of these clinically important outcomes and some data suggests it does not:
  • Reduce risk of aspiration pneumonia
  • Prolong survival
  • Reduce the risk of pressure sores
  • Reduce risk of infections
  • Improve function
  • Provide palliation

  Finucane 1999

FEEDING TUBES

• It is not suggested that NG or PEG tubes never be used. However, if they are, the following should be considered:
  • Use only in absence of pharyngeal swallow/ UES opening
  • Work on restoring swallow with goal of discontinuing tube feedings ASAP, at least within 30 days. This is to avoid adverse events such as AP, unintended catheter removal, poorer nutrition and weight loss
  • “Weight gain must be facilitated by offering tasty and attractive meals and holding off on tube feedings as long as it is safe.” (Langmore, 2002)
  • Perform high-quality, aggressive and frequent oral care
REDUCING PNEUMONIA

DECREASING THE RISK OF ASPIRATION PNEUMONIA

Holistic approach to decrease the risk of AP may include modification of or intervention with one or more of the following:

• Blood Tests
• Suctioning
• Feeding Tubes
• Oral Care
• Mechanically Altered Diets
• Thickened Liquids
• Water Protocols
• Speech Therapy and Therapeutic Exercise
• Referral to Physical Therapy or Occupational Therapy

BLOOD TESTS

A Methodology for the Inclusion of Laboratory Assessment in the Evaluation of Dysphagia Mills 2008

• Blood tests are important as they reveal patient physiological and immune system status, and the relative risk of developing aspiration pneumonia

• Red blood cell count (RBC)
• Hemoglobin (HGB)

• White blood cell count (WBC): leukocytes, neutrophils, basophils, eosinophils, monocytes

• Electrolytes: sodium, potassium, chloride

• Blood urea nitrogen (BUN) and Creatine

• Albumin

BLOOD TESTS

SUCTIONING TRACHEOSTOMIZED PATIENTS

• High-quality and frequent suctioning reduces the risk of AP for those who require this treatment

• Suctioning using good technique should be performed:
• Any time the patient feels or hears mucus rattling in the airway (or trach tube)
• In the morning when the patient first wakes up
• When an increased respiratory rate is noted
• Before meals
• Before going to sleep
• Using separate catheters for oral and tracheal suctioning

ORAL CARE

• There is a strong relationship between oropharyngeal bacteria and the development of pneumonia

• Examination: Look in patient’s mouth once or twice a day for

• Particles of food
• Poor oral hygiene
• Dry mouth
• Signs of bacterial infection

• Good oral care for all patients may prevent recurrent pneumonia episodes as poor dentition, care, and changes in salivary flow are more likely to lead to colonization by pathogenic bacteria

Ferguson 2018
ORAL CARE

Good oral care includes:

- Brushing all areas of the oral cavity including the tongue, palate, cheeks, and sulci. Use a soft toothbrush and do not use gauze or foam swabs.
- Toothpaste that contains additives to assist the breakdown of mucus and biofilm in the mouth
- Use of a non-alcohol based antiseptic mouth rinse
- Referral to dentist (when needed) and periodic teeth cleaning by dental hygienist
- Adequate hydration
- Assistance of lemon glycerin swabs for oral care
- Regularly moisturizing lips and gums using water-soluble moisturizer

FREE WATER PROTOCOL

- In well-controlled clinical trials and operational practices, it has been demonstrated that patients with thin liquid dysphagia have been able to ingest water without complications
- Exclusion criteria used: absent pharyngeal swallow and/or UES opening, active pneumonia, acute or unstable medical condition, uncontrollable oral infection, and/or excessive or uncomfortable coughing after water intake.

THE BENEFIT OF PHYSICAL THERAPY

- The study compared survival rate in hospital patients with aspiration pneumonia who received early rehabilitation versus those who did not receive early intervention
- Early rehabilitation was defined as physical rehabilitation administered by a physical therapist, initiated within 3 days of admission, and undertaken for at least 7 days.
- Typically, physical rehabilitation programs consist of early mobilization and range-of-motion, muscle-strengthening, which have the potential for decreasing post-hospital deconditioning, and the risk of mortality.
- The 30-day in-hospital mortality rates were 5.1% for early physical therapy intervention and 7.1% for delayed physical therapy.
- The authors speculate that early physical therapy may play an important role in improving a patient’s consciousness level, enhancing a patient’s sputum evacuation, dilating the lungs, and subsequently improving airway clearance.

SUMMARY

- The development of aspiration pneumonia is multifactorial and requires more than prandial aspiration
- The effect of diet changes on the development of aspiration is unclear
- There is strong evidence to support aggressive oral care to decrease the bacterial load in the oral cavity, which has a connection to the development of pneumonia
- Active swallow interventions to improve swallow physiology may be helpful in the prevention of pneumonia
- Early mobility in patients with pneumonia may lead to positive outcomes