**Swallowing & Dysphagia**

*Swallowing:* entire act of deglutition which starts from the placement of the bolus in the mouth, through the oral, pharyngeal, and esophageal stages and ends when the bolus enters the stomach

*Dysphagia:* swallowing disorder which can negatively impact the health, nutritional status, and quality of life

---

**Dysphagia and Stroke**

- Dysphagia occurs in 64% to 78% in post-stroke patients regardless of lesion site
- Neurogenic dysphagia may involve difficulties in the oral or pharyngeal stages of swallow
- When the pharyngeal stage of swallow is affected, it can result in aspiration of the bolus and the consequences could be hazardous

---

**Normal Pharyngeal Swallow**

- The hyolaryngeal excursion contributes to
  - Closure of the laryngeal vestibule
  - Opening of UES
- Closure of the laryngeal vestibule serves as a protective mechanism for the airway against aspiration
- Opening of the Upper Esophageal Sphincter (UES) facilitates the movement of the bolus into the esophagus
- Pharyngeal phase extends generally for 0.6 seconds and can last up to one second

---

**Temporal Measurements of Pharyngeal Swallow**

- Temporal measurements evaluate the integrity of the oropharyngeal swallow and serves as a predictive indicator of dysphagia and aspiration
- Facilitate early intervention, thereby reducing the risk of aspiration
- Comprehensive diagnostic and intervention tools for patients with dysphagia

---

**Duration of Stage Transition (DST)**

- Time difference between the point when the bolus first passes the ramus of the mandible and the onset of the superior anterior movement of the hyoid

  *Normative values:*
  - Young adults: zero or negative
  - Older adults: 0.3 to 0.4 seconds
### Duration of Laryngeal Closure (DLC)
- Time between the first and last contact of the arytenoids and epiglottis
- Indicates the efficiency of the laryngeal vestibule closure mechanism in preventing the entry of bolus into the airway
- Normative values:
  - Young adults: 0.51 seconds
  - Older adults: 0.59 seconds

### Duration of Opening of Upper Esophageal Sphincter (DOUES)
- Time between initial opening and closure of the UES
- Indicates the transition between the pharyngeal and esophageal stages of swallowing
- Normative values:
  - Young adults: 0.41 seconds
  - Older adults: 0.48 seconds

### Purpose of the study
- What are the effects of bolus consistencies (thin & nectar thick liquids) on the temporal measures of pharyngeal swallow in elderly control subjects and elderly post-stroke patients who exhibit aspiration and those who do not exhibit aspiration?
- What are the effects of bolus volumes (5ml & 10ml) on the temporal measures of pharyngeal swallow in elderly control subjects and elderly post-stroke patients who exhibited aspiration and those who did not exhibit aspiration?

### Methods
- Analysis of the Video Fluoroscopic Swallowing Examinations (VFSE) of 20 stroke patients and 10 normal subjects.
  - 10 stroke patients who did not exhibit aspiration (non-aspirators)
  - 10 stroke patients who exhibited aspiration (aspirators)
  - 10 subjects who exhibited normal swallow function without any neurological deficits and structural abnormalities (control group).

### Experimental Procedures
- VFSEs were analyzed by using a 100 ms video timer for slow motion frame by frame analysis.
- Lateral view of oral and pharyngeal structures
- Eight swallows for each subject:
  - 2 swallows of 5ml thin liquid
  - 2 swallows of 10ml thin liquid
  - 2 swallows of 5ml nectar thick liquid
  - 2 swallows of 10ml nectar thick liquid

### Temporal Measurements
- Reference points:
  1. Ramus of the mandible
  2. Hyoid bone
  3. Epiglottis
  4. Arytenoid cartilage
  5. Upper Esophageal Sphincter

- Measures:
  1. Duration of Stage Transition (DST)
     - Initiation of max. Hyoid to Ramus of mandible
  2. Duration of Laryngeal Closure (DLC)
     - Final contact of 4 and 3
  3. Duration of Opening of Upper Esophageal Sphincter (DOUES)
     - Closure of 5 opening of 5
Statistical Analysis

- Statistical analysis performed with 3 way ANOVA
- Independent variables:
  - Groups (3)
  - Consistencies (2)
  - Volumes of bolus (2)
- Dependent variables
  - Temporal measurements: DST, DLC, DOUES

Results & Discussion

Duration of Stage Transition (DST)

- Aspirators had the longest DST
- Significant difference among the three groups
- Longer delay of pharyngeal swallow increases the risk for aspiration
- No bolus volume and consistency effects

Duration of Laryngeal Closure (DLC)

- Longest laryngeal closure in the control group
- Significant difference between the stroke patients (aspirators & non-aspirators) and the control group
- Thin liquids required longer DLC in stroke patients

Discussion

- The consistency of the bolus (thin & nectar thick) does not influence the three temporal measures (DST, DLC, & DOUES) of pharyngeal swallow in post-stroke patients
- Volume of the bolus does not influence the three temporal measures (DST, DLC, & DOUES) of pharyngeal swallow in post-stroke patients
Clinical Implications

- Post-stroke patients with aspiration
  - Longer delay of initiation of pharyngeal swallow
  - Reduced protection of the airway
  - Longer UES opening
- Temporal measures are good predictive indicators of aspiration in post-stroke patients

References


Thank you!