**CLINICAL BOTTOM LINE:** Pulse oximetry may be helpful in determining whether a patient has dysphagia, however it is not a reliable measure in detecting episodes of aspiration. SpO2 reduction of >3% was considered significant in determining whether a patient has dysphagia, however it did not correlate with episodes of aspiration.

**Clinical Question [patient/problem, intervention, (comparison), outcome]:** In patients with neurogenic dysphagia, is pulse oximetry a reliable assessment tool for identifying episodes of aspiration?

**Search Terms:** dysphagia; stroke; pulse oximetry; aspiration; swallowing/deglutition; bedside swallowing assessment; videofluoroscopy

**Search Systems:** CIAP: Medline, Embase, Cinahl


**Design:** Non-randomised, prospective, controlled double blind study.

**Participants:**
- 60 patients (43 male, 17 female; ages 19-89 yrs (mean age 61yrs) from among 130 patients with clinically diagnosed dysphagia, from both inpatient and outpatient populations.
- 40 healthy subjects (23 women, 17 men; mean age 40.8±11.7yrs) acted as controls
- All 130 patients were referred for Videofluoroscopic Swallow Study (VFSS) because of clinical suspicion of dysphagia.
- Exclusion criteria: Presence of peripheral vascular disease, Chronic lung disease, smoking history and incomplete VFSS.
- Primary causes of dysphagia were Stroke (Cerebrovascular accident) (N = 27); nasopharyngeal cancer postradiation (N = 10); other neurological causes (N = 16); other non-neurological causes (N = 7).

**Experimental Group:**
- Probes were placed on subjects’ fingers; fingers were kept clean and warm to reduce reading errors due to poor vascularisation; patients were encouraged to keep their arms still to prevent movement artefact.
- Baseline SpO2 was recorded whilst subjects were sitting comfortably, for a minimum of 5 minutes prior to VFSS with 12 second sampling intervals used.
- The timers of VFSS and pulse oximetry recorder were synchronised prior to VFSS examination.
- SpO2 was recorded continuously throughout the VFSS exam and for at least 5 minutes thereafter.
- A research assistant with no knowledge of the VFSS results recorded the SpO2 readings.
- A radiologist performed standardised VFSS with a high resolution super-VHS recorder, providing a frame rate of 30 frames per second. Lateral and frontal anteroposterior views were taken.
- Each subject took 2 doses of 3 standardised formulas (5mL each of thin, thick and paste) of barium sulphate.
- Recordings were made on penetration of the bolus into the laryngeal vestibule, or aspiration of the bolus past the vocal cords, entering the subglottic space.
- The precise time of aspiration or penetration of barium on VFSS was read and recorded for later comparison with episodes of desaturation on pulse oximetry.
**Control Group:**
- Pretest: 40 healthy subjects underwent monitoring of pulse oximetry while drinking water. Subjects had probes on their fingers, which were clean and warm to reduce reading errors due to poor vascularisation.
- Continuous SpO2 readings were taken at 12-second sampling intervals.
- Baseline SpO2 was recorded for 10 minutes with subjects sitting comfortably. The subject was then asked to drink 20mL water twice at a comfortable speed, and SpO2 was then continuously recorded for 5 minutes.

**Results:**
- **Control Group:** The result of the pretest revealed that fluctuation of SpO2 in the 40 healthy subjects is between 1% and 3% (4 subjects – no change to SpO2, 10 subjects – transient 1% decrease, 18 subjects – transient 2% decrease, 8 subjects – transient 3% decrease). While drinking water, none of the control group had a decrease in SpO2 of more than 2%. (The researchers allowed for an error margin of 2% in pulse oximetry accuracy).
- Therefore, in the experimental group, a decrease of more than 3% in SpO2 between the baseline and the lowest level of desaturation was considered significant and was recorded as an episode of desaturation.
- **Experimental Group:** 23 out of 60 patients were defined as aspirators, with 14 of the 23 classed as silent aspiration.
- 12 of 27 stroke patients aspirated on VFSS, and 7 of 12 had a significant reduction in SpO2. Sensitivity and specificity of SpO2 measurement detecting aspiration was 58.3% and 66.7% respectively (not statistically significant)
- No significant difference was observed in age [62 vs 59 years] and baseline SpO2 [96.8% vs 96.7%] between the aspirator and non-aspirator groups, respectively.
- 9 patients (39.1%) out of 23 in aspirator group displayed significant desaturation during VFSS (i.e. >3%).
- 15 patients (40.5%) out of 37 in non-aspirator group displayed significant desaturation during VFSS (i.e. >3%).
- The positive predictive rate of pulse oximetry in detecting aspiration was 37.5%; the negative predictive rate was 61.1%.
- No significant relationship existed between the reduction in SpO2 and aspiration on VFSS using the chi-square test.

**Comments on Design:**

**Strengths:**
- Had a control group
- Assessed the correlation between SpO2 decline on pulse oximetry and aspiration on VFSS.
- Double blinded study (independent raters).
- Reduced possible discrepancies in SpO2 readings by ensuring adequate vascularisation of fingers, and by preventing movement artefact.
- Precise reporting of results
- Thorough description of subjects and the aetiology of their swallowing disorders.

**Weaknesses**
- Relatively small sample size
- Control group and experimental group underwent different assessments (control group did not have VFSS)

**Level of Evidence (NH&MRC): Level 3:2**

**Appraised By:** Adult Swallowing EBP Group

**Date:** June 2009

Form based on Worrall & Bennett, Evidence based Practice: Barriers & Facilitators for Speech-Language Pathologists, Journal of Medical Speech-Language Pathology 2:9, xi – xvi