Original Article

Bedside Thyroid Palpation Technique as Indicator for Penetration/Aspiration Risk in Stroke Patients

Yung-Chun Chi¹², Mu-Hung Tsai¹²³, Jerry Tsung-Kai Lin⁴, Yi-Chen Yu¹², Shih-Chung Chang¹²

¹Department of Physical Medicine and Rehabilitation, Chung Shan Medical University Hospital, Taichung;
²Department of Physical Medicine and Rehabilitation, School of Medicine, Chung Shan Medical University, Taichung;
³Department of Medical Education, Chung Shan Medical University Hospital, Taichung;
⁴Department of Plastic Surgery, Chang-Gung Memorial Hospital Linkou Medical Center, Taoyuan.

Background: Bedside thyroid cartilage palpation technique is a quick and non-invasive swallowing screening test. However, the correlation between thyroid cartilage movement and penetration/aspiration risks in stroke patients has not been conclusive to date. Therefore, we compared the result of videofluoroscopic swallowing study (VFSS) and bedside thyroid cartilage palpation to determine the penetration/aspiration risks in stroke patients.

Material and methods: Our study included 53 patients admitted to a medical center for rehabilitation within 6-months of stroke onset. We recorded penetration-aspiration scale by VFSS and compared it with a bedside thyroid cartilage palpation technique.

Results: Our results show significant higher rates of penetration/aspiration in patients with thyroid elevation ≤1.5 finger widths during palpation compared to >1.5 finger widths (p=0.0223). For the prediction of penetration/aspiration on VFSS, palpation ≤1.5 finger width has a sensitivity of 77.42% (95% CI: 58.90% to 90.41%) and specificity 54.55% (95% CI: 32.21% to 75.61%).

Conclusion: Our results indicate that a ≤1.5 finger width elevation of thyroid cartilage during palpation technique is a sensitive, quick and non-invasive swallowing screening test to evaluate possible risks of penetration/aspiration in stroke patients or used as a follow up examination after VFSS. (Tw J Phys Med Rehabil 2019; 47(2): 109 - 115)

Key Words: dysphagia; penetration; aspiration; thyroid cartilage; palpation

INTRODUCTION

Dysphagia is a common morbidity after stroke. A meta-analysis in 2005 demonstrated that the incidence of dysphagia after stroke from lowest (37% to 45%) by simple screening to highest (64% to 78%) by instrumental testing.¹² Dysphagia often leads to malnutrition, dehydration and pulmonary complication (such as aspiration pneumonia). In dysphagic patients, silent aspiration has been documented in over 40% patients.³

Decreased range of hyoid and laryngeal movement...
during swallow is thought to be associated with increased risk of aspiration, but how much the range of hyo-roid/laryngeal movement associated with aspiration didn’t reach a conclusion in researches of videofluoroscopy swallowing study (VFSS). Although VFSS is currently regarded as gold standard for dysphagia identification and evaluation, a couple of disadvantages hinder its serial follow-up in dysphagic patients including inconvenient portability of huge equipment for examination, exposure to radiation during examination as well as risk of post-VFSS aspiration. Clinically the physician or speech-language pathologist evaluate laryngeal move-

MATERIALS AND METHODS

Participants

During August 29th, 2017 till May 1st, 2018, dys-

Palpation technique

Each patient underwent palpation examination modified from Joseph Murray during dry swallowing performed by two physicians before VFSS. The palpation method is shown as Figure 1. Examiner’s ring finger was put horizontally above superior border of superior thyroid notch. Middle finger and index finger are placed at the most anterior part of hyoid bone and submental area, respectively. The patients then followed instruction to perform dry swallow, and in the meanwhile, the examiner recorded the movement distance of thyroid cartilage in numbers of finger width. In our study, 2 cm approxi-

VFSS examination

All the VFSS were performed by an experienced physician using a fluoroscopy unit (Axiom Luminos dRF, Siemens, Germany), and the images were digitally re-

Penetration-Aspiration assessment

We use the 8-point Penetration-Aspiration Scale (PAS) for VFSS rating by referring those with PAS ≥2 as penetration/aspiration (PA) group and those with PAS=1 as non-penetration/aspiration (NPA) group. Penetration was defined as bolus dropping into laryngeal inlet but
Thyroid palpation and risk of penetration/aspiration in stroke patients

above the true vocal cord, and aspiration was defined as the passage of bolus beyond true vocal cord.[13]

**Statistical Analysis**

We used GraphPad Prism 7.01 (GraphPad Software, Inc., San Diego, CA) to do the statistical analysis in our study. We used Non-paramatic Mann-Whitney U tests to compare age between NPA/PA group. We used fisher exact test to compare gender, stroke type, affected side and laryngeal elevation by palpation (>1.5 finger width or ≤1.5 finger width) with NPA/PA group.

**RESULTS**

A total of 53 patients met our inclusion criteria as are shown in Table 1. No significant difference was found between NPA and PA group in gender (p=0.57), age (p=0.84), stroke type (p=0.8391) and affected side (p=0.0912).

Dysphagic patients with thyroid cartilage elevation ≤1.5 finger widths during palpation showed significant higher rate of penetration/aspiration compared to those with thyroid cartilage elevation >1.5 finger widths (p=0.0223) (Table 1). For the prediction of penetration/aspiration on VFSS by palpation, thyroid cartilage elevation ≤1.5 finger width has a sensitivity of 77.42% (95% CI:0.5890-0.9041) and a specificity of 54.55% (95% CI: 0.3221-0.7561) (Table 2).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>NPA group (PAS=1)</th>
<th>PA group (PAS=2-8)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gendera</td>
<td>22</td>
<td>31</td>
<td>0.57</td>
</tr>
<tr>
<td>Male</td>
<td>13</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>9</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Ageb (years)</td>
<td>60.0±11.2</td>
<td>60.5±12.7</td>
<td>0.84</td>
</tr>
<tr>
<td>Finger palpationa &gt; 1.5 finger width</td>
<td>12</td>
<td>7</td>
<td>0.0223*</td>
</tr>
<tr>
<td>≤1.5 finger width</td>
<td>10</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Stroke type a</td>
<td>Ischemic</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>Hemorrhagic</td>
<td>14</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Mixed</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Affected Sidea</td>
<td>Left</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>Right</td>
<td>14</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Bilateral</td>
<td>4</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

The results are expressed as mean with standard deviations. Significance was set at p<0.05 (two-tailed) with asterisk. NPA: non-penetration/aspiration group. PA: penetration/aspiration group. a: number of subjects. b: mean± standard deviation.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
<th>95% Confidential interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>77.42%</td>
<td>58.90% to 90.41%</td>
</tr>
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<td>Specificity</td>
<td>54.55 %</td>
<td>32.21% to 75.61%</td>
</tr>
</tbody>
</table>
**DISCUSSION**

Adequate hyolaryngeal movement is considered to be important in airway protection and upper esophageal sphincter opening during swallowing.[14] Previous studies showed a positive correlation between decreased hyoid elevation and aspiration, and as a result, hyoid bone movement was commonly measured as the indicator of movement adequacy. [4-13-21]

A systematic review in 2015 compared several bedside examinations (such as observation of clinical signs for dysphonia, dysarthria, oral dyskinesia, et al.) to the result of VFSS or fiberoptic endoscopic evaluation of swallowing (FEES) for the diagnosis of dysphagia. However, none of them provided adequate prediction of aspiration.[22] It is observed that normal subjects elevate larynx around 2-2.5 cm during swallowing.[2] Given that 1.5 finger width of our examiners measured around 2cm, laryngeal elevation ≤1.5 finger width is considered inadequate. This method offered clearer as well as easier measurement of the track and the numbers of finger width by which thyroid cartilage travelled. It also showed good sensitivity in predicting penetration/aspiration when thyroid elevation ≤1.5 finger widths during palpation with a sensitivity of 77.42% (95% CI: 0.5890-0.9041) and a specificity of 54.55% (95% CI: 0.3221-0.7561). It is a simple and straightforward way to evaluate patients of suspected high risk of penetration/aspiration at clinic without VFSS facilities available as well as to follow-up swallowing ability after VFSS examination due to serial VFSS exposure considered to be hazardous. The major function of laryngeal elevation (thyroid cartilage) is to stretch open upper esophageal sphincter (UES), with traction to anterior wall of the sphincter during swallowing.[2] Inadequate laryngeal elevation such as ≤ 1.5 finger width perhaps indicates insufficient muscle power from stroke to complete the elevation of larynx. Thus, there is higher risk of penetration/aspiration in those patients with laryngeal elevation ≤1.5 finger width.
CONCLUSION

Our VFSS demonstrates that when patients’ thyroid cartilage fails to elevate more than 1.5 finger width (approximate 2 cm width) by our palpation technique during swallowing, a significant higher penetration/aspiration risk occurs. This palpation technique may be used as a simple test for screening of those stroke patients with higher risk of penetration/aspiration or used as a follow up examination after VFSS.

LIMITATIONS

Our study has some potential limitations. First, small sample size may affect our results. Second, our study focused on stroke patients within 6 months from onset without any other comorbidities, thus, the results may not applicable to stroke patients in chronic stage or with other comorbidities.

Finally, though in our study, 2cm approximates 1.5 finger width of our examiner, it may not be universal true in every person. Thus, adjustment should be made accordingly. Nevertheless, this study still offered us an idea of using simple palpation technique to predict aspiration/penetration risk in stroke patients.

ACKNOWLEDGEMENT

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REFERENCE


以床邊甲狀軟骨觸診預測中風病人吸入／嗆入風險

齊永均 1,2 蔡牧宏 2,3 林琮凱 4 游宜蓁 1,2 張時中 1,2

中山醫學大學附設醫院 復健科 1 中山醫學大學醫學系 復健學科 2
中山醫學大學醫教部 3 林口長庚醫院 整形外科 4

背景：床邊甲狀軟骨觸診是一個迅速且非侵入式的吞嚥篩檢測試，然而截至目前為止甲狀軟骨的移動與中風病人吸入/嗆入的風險仍未有結論。因此我們藉著比較床邊甲狀軟骨觸診與螢光吞嚥攝影檢查結果，來找出甲狀軟骨移動與中風病人吸入/嗆入風險的關係。

方法：我們的研究收錄 53 位中風六個月內住在醫學中心的病人，並記錄吞嚥時觸診的甲狀軟骨移動距離與吞嚥攝影的吸入/嗆入分數(PAS score)做比較。

結果：我們的結果顯示吞嚥時甲狀軟骨觸診上升距離≤1.5 指幅（約 2 公分）的病人吸入/嗆入的風險比上升＞1.5 指幅的病人高，且有統計學上顯著差異(p=0.0223)。而用≤1.5 指幅甲狀軟骨上升來預測病人吸入/嗆入風險與吞嚥攝影做對照，敏感性及特異性分別可達 77.42% (95% CI: 58.90% to 90.41%)、54.55% (95% CI: 32.21% to 75.61%)。

結論：我們的結果顯示以吞嚥時觸診甲狀軟骨上升距離≤1.5 的指幅來預測中風病人吸入/嗆入風險是一個敏感性高、迅速且非侵入性的篩檢方法，並作為螢光吞嚥攝影檢查後吸入/嗆入風險患者的追蹤評估方式。（台灣復健醫誌 2019; 47(2): 109 - 115）

關鍵詞：吞嚥障礙(dysphagia)、嗆入(penetration)、吸入(aspiration)、甲狀軟骨(thyroid cartilage)、觸診(palpation)