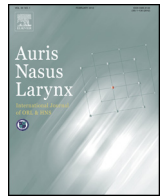




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Mano-videoendoscopic assessment in the evaluation of the pharyngeal contraction and upper esophageal sphincter function in dysphagic patients[☆]

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ABSTRACT

Objective: Mano-videoendoscopy (MVE) is a manometry technique with endoscopic confirmation of the pressure catheter. This study aimed to investigate the possibility of replacing a videofluorographic swallowing study (VFSS) with MVE for the precise evaluation of the pharyngeal contraction and the upper esophageal sphincter (UES) function.

Methods: The data from 69 patients with dysphagia were retrospectively reviewed. All of the patients underwent both MVE and a VFSS for the evaluation of dysphagia. Manometry was performed with a transnasally inserted catheter (2.6-mm outer diameter and 4 pressure sensors) under endoscopic observation. The sensors were kept at the tongue base, upper pyriform sinus, apex of the pyriform sinus, and UES. We evaluated the pharyngeal contraction and UES function fluorographically and statistically compared the manometric parameters.

Results: The fluorographic pharyngeal contraction was diagnosed as good in 28 patients and poor in 41 patients. The UES opening was diagnosed as good in 44 patients and poor in 25 patients. The highest pressure values at the tongue base (sensor 1), upper pyriform sinus (sensor 2), and apex of the pyriform sinus (sensor 3) were significantly larger in the good contraction group than in the poor contraction group. A stepwise logistic regression test revealed that the peak pressure of sensor 2 (upper pyriform sinus) was a robust predictor of fluorographic pharyngeal contraction, and the cut-off level for good fluorographic pharyngeal contraction was >81.5 mmHg (specificity, 0.929; sensitivity, 0.870; area under the curve, 0.923). The nadir pressure, pressure drop, and pressure rise in the UES were significantly correlated with the fluorographic UES opening. A stepwise logistic regression test revealed that the pressure drop—the gap between the resting pressure and the nadir of the UES pressure—was a robust predictor of fluorographic UES opening, and the cut-off level to anticipate good fluorographic opening was ≥ 33.5 mmHg (specificity, 0.853; sensitivity, 0.759).

Conclusion: MVE can supplement the information obtained regarding the pharyngeal contraction and UES function, and overcomes the drawbacks of a videoendoscopic swallowing study (VESS).

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1. Introduction

Swallowing is a complex action with a simple result: transfer of a bolus from the oral cavity to the proximal esophagus. For this action to be accomplished, the pharynx must be transiently altered from its resting state as a respiratory conduit into a gustatory conduit in which the nasopharynx and laryngeal inlet are sealed and the oropharynx instead leads to an opened upper esophageal sphincter (UES) [1]. The bolus is sent from the pharynx to the esophagus by the tongue base movement and the pharynx constriction, and the bolus passes through the pharyngoesophageal (PE) segment as the UES relaxes simultaneously.

Both the contraction of the pharynx and the relaxation of the UES are crucial for safe swallowing. When examining the swallowing function of patients with dysphagia, it is important in the subsequent development of a treatment strategy to evaluate the pharyngeal contraction and UES relaxation [2].

Videofluoroscopy is a primary examination tool for evaluating bolus transit, residue, and aspiration, and is often used to guide assessment and therapy [3]. However, the limitations to fluoroscopy include a prolonged exposure to radiation and the primarily qualitative nature of the information obtained, although some numerical measures may be derived, such as the timing of the opening or closing of the velopharyngeal junction, tongue base, and posterior pharyngeal wall (PPW), and UES [4].

An objective, non-radiological, and easily administered test for assessing the swallowing function could be a useful adjunct to radiology, especially when patients must be monitored over longer periods of time to assess the response to an intervention or to monitor the trajectory of the swallowing function in cases of progressive disease [5]. Videoendoscopic swallowing study (VESS) meets these criteria and has been shown to be useful in detecting secretions not visualized on videofluoroscopy, as well as silent aspiration. However, this technique does not provide quantitative information on the changes in the pressure underlying bolus transit [3].

Manometry is used to measure the pressure in the pharynx and esophagus during swallowing and enables the observation of the swallowing pressure, which indicates the force of the propulsion of a bolus at the base of the tongue and the relaxation status of the UES [2]. However, in patients with pharyngeal dysphagia, the pressure catheter is sometimes accidentally inserted into the larynx instead of the esophagus. The combination of manometry and VFSS or VESS is safe and may allow the clinician to pair findings with quantitative information on the strength and speed of the swallow to better understand the underlying swallowing problem [6]. Mano-videoendoscopy (MVE) is a technique used to obtain additional manometric information, such as data on the pharyngeal contraction and UES relaxation, after a routine VESS [2].

In a preliminary study, we statistically compared the manometric parameters of UES relaxation with those of fluorographic UES opening and found that MVE can provide supplementary information on the UES function [2]. The aim of the present study was to investigate the possibility of replacing

the VFSS with MVE in the objective and quantitative evaluation of both the pharyngeal contraction and UES function.

2. Materials and methods

2.1. Participants

All of the subjects were patients with dysphagia. From September 2012 to June 2014, 306 patients were referred to the Swallowing Center for an assessment of their swallowing function in an outpatient setting. All 306 patients underwent a VFSS and VESS. In 69 patients, MVE was also performed to obtain precise information about the pharyngeal contraction and UES function. The inclusion criteria for this study were the presence of dysphagia and informed consent from the patient to undergo a VFSS and MVE. The exclusion criteria were age less than 20 years old, current pneumonia, and severe dementia. The study participants were 54 males and 15 females, with an age range of 34–97 years. Their primary diseases are described in Table 1.

Fourteen patients had experienced cerebrovascular accidents, and the other patients had various other diseases. Informed consent was obtained from each patient for the evaluations and analysis and publication of their data. This study protocol was approved by the Research Ethics Committee of our University.

2.2. Apparatus

The Mogram Stealth, a manometry and video synchronized recording and analyzing system (Star Medical Co., Tokyo, Japan), was utilized for MVE. The videoendoscope system used was the VISERA Pro (Olympus Medical System Co., Tokyo, Japan), with an endoscopic diameter of 3.9 mm. The manometry catheter was 100 cm long and 2.6 mm in outer diameter (UniTip Katheter; Unisensor, Attikon, Switzerland), with 4 solid-state circumferential sensors, each 2 cm apart. The sensor sensitivity was 5 uV/V/mmHg ($\pm 2\%$). Digital 12-bit samples were obtained via a GMMS pocket monitor (4ch pocket monitor GMMS-400; Star Medical Co.) with a sampling frequency of 100 Hz and presented in a display window. The Eight STAR for

Table 1
Patient characteristics.

Characteristic	
Sex	
Male	54
Female	15
Average age, yy (range)	72 (34–97)
Primary disease	
Cerebrovascular accident	14
Parkinson disease/syndrome	11
Aspiration pneumonia	10
Unknown	6
Brain tumor	5
Amyotrophic lateral sclerosis	3
Post-cervical spine surgery	2
Others	18

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