The Usefulness of Swallowing Pressure Assessment in the Identification of Mild Pharyngeal Weakness of Myasthenia Gravis: A Case Report

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Abstract
Despite the clinical impact of dysphagia in myasthenia gravis (MG), a standard protocol for diagnosing dysphagia reliably has not yet been established. High-resolution manometry (HRM) provides precise information on pharyngeal pressure. We hypothesized that swallowing pressure assessment using HRM during the edrophonium chloride (EC) test could identify mild bulbar symptoms with no abnormalities on videoendoscopic (VE) and videofluorographic (VF) examination of swallowing, and we tested this hypothesis on a 72-year-old female patient diagnosed with ocular MG who developed slight pharyngeal discomfort over 3 months. The patient’s ocular symptoms were stable with pyridostigmine medication. VE and VF revealed no abnormalities. The swallowing pressure along the pharynx was measured using HRM during the EC test. HRM parameters, including velopharyngeal contractile integral and meso-hypopharyngeal contractile integral, were evaluated. These parameters were assessed for three swallows using 3 mL of water. After EC injection, the values of the velopharyngeal contractile integral (78.0 ± 5.4 vs. 134.7 ± 1.3 mm Hg cm·s) and the meso-hypopharyngeal contractile integral were both higher (130.6 ± 1.5 vs. 284.2 ± 11.9 mm Hg cm·s) than those observed before EC injection. Chest computed tomography revealed a thymoma that had not been observed in previous examinations. The patient was diagnosed with thymoma-associated MG.
Intravenous immunoglobulin therapy improved the mild dysphagia. We concluded that swallowing pressure assessment during the EC test may be helpful in identifying mild bulbar symptoms in patients with MG.
mean values of these parameters increased after EC injection. After 8 mg EC injection, the VPCI (78.0 ± 5.4 vs. 134.7 ± 1.3 mm Hg cm·s) and MHPICI (130.6 ± 1.5 vs. 284.2 ± 11.9 mm Hg cm·s) values were both higher than before EC injection. The UES relaxation time and UES nadir pressure did not change after the EC injection.

Computed tomography of the chest revealed a thymoma that had not been observed during previous examinations. We diagnosed a transformation from ocular MG to generalized MG caused by thymoma-associated MG. Intravenous immunoglobulin therapy improved the mild dysphagia and cervical muscle weakness, and thymectomy was performed. The pathological examination of the lesion revealed a type B2 thymoma (size: 4.0 × 1.4 × 3.5 cm).

**Discussion**

This is the first report of MG with mild bulbar symptoms identified based on increased pharyngeal pressure during the EC test using HRM. The diagnosis of bulbar MG is clinically challenging [3], and some patients could be misdiagnosed using standard assessment methods [2]. Evaluation of swallowing pressure during EC test with HRM may be useful for identifying
mild pharyngeal weakness, which is difficult to evaluate using conventional standard assessments, including VE and VF.

In the present case, the only bulbar symptom was a very slight feeling of discomfort in the pharynx. MG patients with dysphagia present decreased pharyngeal clearance [3, 7, 9], but VE revealed no abnormalities, such as pooling of the saliva. Although pharyngeal residues have been reported in MG-related dysphagia [2, 7, 9, 10], VF revealed no pharyngeal residues or penetration/aspiration in our patient. Interestingly, we could identify mild bulbar symptoms that were undetectable by evaluation of swallowing function using VE or VF.

The strength of this evaluation is that the increase in pharyngeal contraction during the EC test was quantitatively evaluated. The increased VPCI and MHPCI reflect improved soft palate closure and pharyngeal contraction, respectively. The evaluation of swallowing pressure using HRM provides objective values for the increase in soft palate closure and pharyngeal contractility during the EC test. A manometric study during the EC test is highly reliable, without variation in measurement results between clinicians.

One of the mechanisms of MG-related dysphagia is the weakness of the posterior pharyngeal muscles [3]. Furthermore, weakness of the suprahypopharyngeal muscles leads to impaired opening of the UES. In the present case, HRM revealed weakness of the pharyngeal muscles; however, the UES function was preserved. Some patients with MG-related dysphagia present with UES dysfunction [11]. Submental and laryngeal elevators associated with UES opening are clinically involved in MG [12]. Thus, HRM could be used to evaluate weakness of the pharyngeal muscle and/or suprahypopharyngeal muscles before and after intravenous EC injection in diagnosing MG patients. The strength of evaluation by HRM might be that it is able to assess slight muscle weakness in swallowing-related muscles for early diagnosis or identification of recurrence, before serious complications develop. In summary, swallowing pressure assessment during the EC test may facilitate identification of very mild bulbar symptoms in patients with MG.

**Statement of Ethics**

This case report did not require the Ethics Review Committee of the Gifu University Graduate School of Medicine in accordance with local or national guidelines. Written informed consent was obtained from the patient for publication of the details of the medical case and any accompanying images.

**Conflict of Interest Statement**

The authors have no conflicts of interest to declare.

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**Author Contributions**

Kenjiro Kunieda, Yuichi Hayashi, and Nobuaki Yoshikura: determined the diagnosis and treated the patient. Kenjiro Kunieda and Yuichi Hayashi: drafted the manuscript. Tomohisa Ohno: performed the statistical analysis. Kenjiro Kunieda, Yuichi Hayashi, Akio Kimura, Ichiro
Fujishima, and Takayoshi Shimohata revised the manuscript. Kenjiro Kunieda, Yuichi Hayashi, Nobuaki Yoshikura, Tomohisa Ohno, Akio Kimura, and Takayoshi Shimohata read and approved the final version of the manuscript.

Data Availability Statement

All data generated or analyzed during this study are included in this article. Further inquiries can be directed to the corresponding author.

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