

# Assessment of swallowing function and muscle using ultrasonography in general and family medicine

Assessment of swallowing function is a must in general and family medicine. Major causative diseases of dysphagia are stroke, dementia, sarcopenia, and aspiration pneumonia. General and family physicians often examine dysphagic patients with stroke, dementia, sarcopenia, and aspiration pneumonia, because all of them are common diseases in superaged society like Japan. Some older patients with dysphagia require food texture modification to prevent aspiration pneumonia. Assessment of swallowing function including lower-jaw mobility is important to judge the necessity of food texture modification.<sup>1</sup> Assessment of swallowing function is performed by general and family physicians or other healthcare workers.

Screening tests of swallowing function are useful in clinical practice, however, less accurate than videofluoroscopic swallowing study (VF) and videoendoscopic swallowing study (VE). Water-swallowing test, food test, pulse oximetry, cervical auscultation, and the Eating Assessment Tool-10 are used commonly in clinical practice for dysphagia screening. These screening tests can be used whether oral intake can be started or not. VF uses modified food containing barium taking X-rays from the side or front and recording fluoroscopic images. VE uses fiberoptic inserted from the nasal cavity to directly observe the pharynx. VF and VE are useful for more accurate evaluation of pharyngeal residue, aspiration, movement of swallowing muscles, and starting oral intake. However, VF requires radiology

and fluoroscopy room, and VF testing time should be limited to avoid excessive radiation exposure. VE has some invasion due to inserted fiberoptic, and VE cannot evaluate esophageal phase.

Ultrasonography is useful to assess swallowing function in clinical practice. General and family physicians are accustomed to performing ultrasonic inspection. Ultrasonography has been used to assess dysphagia for a long time in research.<sup>2</sup> In contrast, ultrasonography has been rarely used to assess dysphagia in clinical practice. However, ultrasonography is a more detailed assessment of swallowing function than screening tests without invasion. Evaluating vocal cord paralysis is easy. Aspiration is detected as hyperechoic, long, narrow objects that passed through the vocal folds beneath the anterior wall of the trachea in B-mode video ultrasonography.<sup>3</sup> The sensitivity of aspiration detection was 0.64, and the specificity was 0.84.<sup>3</sup> Pharyngeal residue in the pyriform sinus and epiglottic vallecula is detected as high-echogenicity areas in B-mode video ultrasonography.<sup>4</sup> The sensitivity of detecting pharyngeal residue in the pyriform sinus was 92.0%, and the specificity was 71.9%.<sup>4</sup> The sensitivity of detecting pharyngeal residue in the epiglottic vallecula was 86.7%, and the specificity was 63.6%.<sup>4</sup> Moreover, swallowing care guided by frequent ultrasound examinations during mealtimes had a trend of reducing the frequency of aspiration and residue in a randomized controlled trial.<sup>5</sup> Therefore, ultrasonography should be used to assess swallowing function in clinical practice.

**TABLE 1** Comparison of swallowing evaluation methods

	Screening tests	Videofluoroscopy: VF	Videoendoscopy: VE	Ultrasonography
Aspiration	+	+++	++	++
Pharyngeal residue	+	+++	+++	++
Vocal cord paralysis	-	++	+++	+++
Cricopharyngeal dysfunction	-	+++	-	+
Esophageal phase	-	+++	-	+
Sensory	-	+	+++	-
Swallowing-related muscles	-	+	-	+++
Nonphysician implementation	+++	-	-	++
At home or at bedside evaluation	+++	-	++	++

Note: -: unevaluable; +: partially evaluable; ++: evaluable; +++: optimally evaluable.

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Another advantage is that ultrasonography can evaluate swallowing muscle mass and quality. Sarcopenic dysphagia is defined as dysphagia caused by sarcopenia of the whole body and swallowing-related muscles.<sup>6</sup> The prevalence of sarcopenic dysphagia in patients who require dysphagia rehabilitation was as high as 32%, and sarcopenic dysphagia was independently associated with poor swallowing function.<sup>7</sup> Sarcopenic dysphagia should be evaluated in all patients with dysphagia or sarcopenia, because sarcopenic dysphagia is common in superaged society. Ultrasonography can evaluate muscle mass and quality of the whole body and swallowing-related muscles. The tongue muscle is one of the swallowing-related muscles. The tongue muscle area and brightness were independently associated with sarcopenic dysphagia.<sup>8</sup> Therefore, ultrasonography is useful for evaluating swallowing-related muscles and sarcopenic dysphagia.

Ultrasonography can be performed not only by general and family physicians but also by nurses, speech-language pathologists, dentists, dental hygienists, and other healthcare workers. Moreover, ultrasonography can be performed at home or at bedside (Table 1). Therefore, I expect that many general and family physicians will use ultrasonography to assess swallowing function and muscle in clinical practice.

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#### CONFLICT OF INTEREST

The authors have stated explicitly that there are no conflicts of interest in connection with this article.

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