During EGD, extending the gastric wall by air infusion is important to avoid oversight of lesions and allow for accurate evaluation of their characteristics. If stomach inflation is insufficient, the lesions may be hidden between the gastric folds (Fig. 1). Frequent deflation during endoscopic air infusion tends to occur in patients with hiatal hernias; thus, adequate extension of the stomach is difficult in these patients (Fig. 2).

We herein describe the use of cricoid pressure to prevent gastric deflation during EGD (Video 1, available online at www.VideoGIE.org). A cricoid pressure technique called Sellick’s maneuver is typically used to exert external mechanical pressure with a force of 30 N on the cricoid cartilage to prevent aspiration of gastric contents during emergency induction of anesthesia (Fig. 3A). A previous study suggested that cricoid pressure >20 N can cause neck pain and discomfort in conscious patients and that a pressure of >40 N can cause airway obstruction. Vomiting during application of cricoid pressure may cause esophageal rupture, because of rapid intraesophageal pressure increase.

After obtaining appropriate ethical approval and informed consent, we applied cricoid pressure during EGD in patients who were unable to maintain air pressure in the stomach (Fig. 3B). With the patient in the left lateral decubitus position, we bent the head back, supported the back of the neck, and pressed the cricoid cartilage gently backward with a force of <20 N (Fig. 4). If the patient felt pain, began vomiting, or exhibited an unstable respiratory condition, we immediately released the pressure. The application of cricoid pressure provided full extension of the stomach without deflation (Fig. 5), and the hypopharynx was closed while the airway remained open (Fig. 6).

We retrospectively reviewed 38 consecutive patients who experienced frequent gastric deflation and underwent the application of cricoid pressure during EGD among 368 patients who had undergone sedated EGD in our hospital from April to July 2017. We evaluated the patients’ characteristics, presence or absence of a hiatal hernia, midazolam dose, success rate, and adverse events. We defined success as prevention of gastric deflation by the application of cricoid pressure, full gastric extension, and adequate evaluation of the gastric wall characteristics. Hiatal hernia was defined as grade III or IV in the classification of Hill et al.

Figure 1. A, Inadequate extension of the gastric wall, causing difficulty observing the detailed structure between the folds. B, Full extension of the stomach, revealing gastric cancer in the posterior wall of the gastric body.

Written transcript of the video audio is available online at www.VideoGIE.org.
Figure 2. A, Endoscopic image of the cardia without hiatal hernia. B, Air infusion by endoscopy resulting in maintenance of air pressure and full extension of the stomach. C, Endoscopic image of the cardia with hiatal hernia. D, Deflation of stomach resulting from release of air through the hiatal hernia.

Figure 3. A, Illustration of cricoid pressure during rapid sequence induction, Sellick’s maneuver. B, Cricoid pressure during EGD.

Figure 4. During EGD, we bent the head back while supporting the back of the neck, and then pressed the cricoid cartilage gently backward.
The mean age in the subject group (cricoid pressure) was 5.9 years older than that in the control group (no cricoid pressure) (75.2 ± 8.1 vs 69.3 ± 12.5 years, respectively). The rate of hiatal hernia was significantly higher in the subject group than in the control group (63% vs 33%, respectively). The median midazolam dose was the same in both groups (Table 1).

The only significant difference between patients who underwent effective and ineffective application of cricoid pressure was age; the mean age of the 4 patients with ineffective pressure application was 9.4 years younger than those with effective pressure application (76.2 ± 8.0 vs 66.8 ± 3.9 years, respectively) (Table 2). The reported adverse events were mild neck pain and

**Table 1. Patient characteristics**

|                          | Cricoid pressure group (n = 38) | Control group (n = 330) | P value |
|--------------------------|---------------------------------|-------------------------|---------|
| Male, n (%)              | 26 (68%)                        | 199 (60%)               | .38     |
| Age, mean ± SD, years    | 75.2 ± 8.1                      | 69.3 ± 12.5             | <.05    |
| Hiatal hernia, n (%)     |                                 |                         |         |
| (+)                      | 24 (63%)                        | 108 (33%)               | <.05    |
| (−)                      | 14 (37%)                        | 222 (67%)               |         |
| Midazolam, median (range), mg | 2.5 (1-5.5)                  | 2.5 (1-7.5)             | .33     |

SD, Standard deviation.

**Figure 5.** A, Insufficient extension of the gastric wall because of frequent gastric deflation, despite continuous air infusion. B, After the application of cricoid pressure, no deflation occurred, and the gastric wall was fully extended with air infusion.

**Figure 6.** A, Endoscopic image of the pharynx before cricoid pressure application. B, After cricoid pressure application, the hypopharynx was closed but the airway remained open.
discomfort. Our success rate was 89.5% (34 of 38 patients).

In conclusion, we observed a higher rate of gastric deflation among older patients and those with hiatal hernias. The application of cricoid pressure had a higher failure rate among younger patients. This might have been due to the stronger upper esophageal sphincter and weaker sedation among younger patients. The application of cricoid pressure requires no equipment, is highly effective, and has a low rate of adverse events. We consider this technique to be a simple, effective, and safe procedure for the prevention of gastric deflation during sedated EGD.

**DISCLOSURE**

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