Zenker’s diverticulum (ZD) is a rare pulsion type diverticulum that develops at pharyngoesophageal junction and usually manifests in seventh or eighth decade of life. The diagnosis of ZD is established with gastroscopy and oral contrast or barium swallow study. The latter is especially useful in defining the size and dimensions of the diverticulum (Fig. 1). Majority of the symptomatic patients present with dysphagia, regurgitation, halitosis or chronic cough. The severity of symptoms can be assessed objectively by several assessment tools like Dakkak and Bennett scale, Swallowing-Quality of Life, and Eating Assessment Tool.

The management options of ZD include surgery, rigid endoscopy and flexible endoscopic diverticulotomy (FED). Over the last several decades, FED has emerged as a safe and effective alternative to surgery. The advantages of flexible endoscopic treatment over open surgery include comparable outcomes, reduced morbidity and flexibility to perform under deep sedation.

Endoscopic treatment of symptomatic ZD has been established as a safe and effective treatment option with fewer morbidities as compared to surgery. Endoscopic treatment methods include rigid and flexible endoscopic division of septum. The rigid transoral approach requires the placement of a rigid diverticuloscope followed by division of the cricopharyngeal septum using carbon dioxide laser or a stapling device. The major limitations of rigid endoscopy include requirement of general anaesthesia, and relative contraindication in those with limited cervical spine mobility and small size diverticulae (< 3 cm). For the same reason, FED is increasingly being utilized and preferred over rigid endoscopy techniques.

Devices and Accessories

The procedure of FED requires a high definition flexible endoscope (preferably the one equipped with water jet), transparent hood, soft diverticuloscope, electrosurgical knife, electrosurgical generator, CO₂ insufflator, coagulation forceps, guidewire, and...
The use of a nasogastric tube is optional and depends on the operator’s preference (Fig. 2). The division of the cricopharyngeal septum is performed by an electrosurgical knife. The choice of electrosurgical knife is largely operator dependent. Different knives described in literature for ZD include needle knife, hook knife, scissor type knives, and triangular knife (Fig. 3). Of these, needle knife and hook knife are the most commonly utilized. Hook knife may be especially useful as it allows pulling of the muscle fibers for precise cutting and reduces the chances of inadvertent deep injury at the bottom of the septum. In addition, FED has also been performed using harmonic scalpsels, LigaSure device and the stapling device. The latter three devices have not been designed specifically for flexible endoscopic use and are required to be passed alongside the endoscope rather than the endoscope channel. Irrespective of the knife or the technique utilized, flexible endoscopic treatment aims at near complete division of the cricopharyngeal septum and minimize complications.

Table 1 describes the different types of knives and the settings on electrosurgical generator used in various studies.

**Technique of Flexible Endoscopic Diverticulotomy**

The technique of FED is not standardized and considerable variations exist in practice. The procedure can be performed under general anaesthesia or deep sedation using propofol. The steps of FED in our unit are as follows: 1) cleansing of the diverticulum of all the food debris (Fig. 4A); 2) placement of a soft diverticuloscope (ZDO-22/30; Cook Medical, Limerick, Ireland) so that the longer limb occupies the esophageal lumen and the shorter limb fits into the diverticulum (Fig. 4B); 3) gradual withdrawal of the endoscope to check the optimal position of the diverticuloscope; 4) incision of the mucosa over the septum followed by septotomy using an electrosurgical knife (Fig. 3B); 5) division of the septum till the visualization of the muscle fibers at the bottom of the septum (Fig. 4C); 6) prophylactic placement of one or more endoclips at the base of the cut end of septum (Fig. 4D).

In case, a diverticuloscope is not used (small diverticulum < 2–3 cm or operator’s preference) a distal transparent cap is often attached to the tip of endoscope for better visualization and separation of myotomy edges. A nasogastric tube placed over the guidewire is also useful as it guides the direction of myotomy, improves the visualization of the septum and protects the contralateral esophageal mucosa from thermal injury. In addition, it provides for the feeding route in case of an inadvertent perforation.

**Outcomes of Flexible Endoscopic Treatment**

The outcomes of FED are mainly dependent on the operator’s experience and the size of the diverticulum. These factors partly explain the wide range of reported clinical success which ranges from 60%–100% in the published literature. Majority of the recent studies reveal a success rate of 80%–90% (Table 2). Whether, the difference in the technique used for FED impacts the incidence of recurrences is debatable. Some experts extend the myotomy beyond the tip of the diverticulum. Whereas, others avoid a complete myotomy to reduce the risk of perforation. The argument in favor of the latter approach is that reasonable outcomes can be achieved with a second session of endotherapy in cases with recurrence. However, regardless of the technique used recurrent symptoms have been reported in up to 20%–25% of patients after flexible endoscopic treatment. Majority of the recurrences are still amenable to a repeat flexible endoscopy treatment. In a large study (n = 150), twenty three patients underwent re-treatment for recurrent symptoms. Of these, 18 and 4 patients were free of symptoms after second and third session of endoscopic treatment. The predictive factors for recurrence include large size of the diverticulum (≥ 50 mm) and a small septotomy length ≤ 25 mm. The impact of using a diverticuloscope on treatment success and recurrence is debatable. In a review including 23 studies (997 patients), the use of diverticuloscope was associated with higher.

**Fig. 1.** Barium swallow in a case of Zenker’s diverticulum. Note the well-defined dimensions of the diverticulum with barium study.

**Fig. 2.** (A) Endoscopic view of recurrent Zenker’s diverticulum. (B) Endoscopic view in the same case after placement of a soft diverticuloscope. Note the well demarcated sides of the septum after placement of diverticuloscope and the presence of sutures due to previous surgery.
recurrence of symptoms (16.5% vs 9.5%). On the contrary, clinical outcomes were similar with or without the use of a diverticuloscope in another study.

Adverse Events

FED is a safe procedure and major adverse events are rare. Intraprocedural bleeding is common but endoscopic coagulation is sufficient in vast majority of the cases. Perforation occurs in about 4% cases and is the most dreaded complication associated with FED. In a systematic review, the median rate of overall adverse events and perforation was 14.1% and 6.5% (0%–27.3%), respectively. In our practice, we routinely place endoclips after completion of the diverticulotomy to reduce delayed bleeding and perforation. However, this is not evidence based and randomized comparison studies are warranted. The use of diverticuloscope was shown to reduce the incidence of perforations when compared to the cap assisted technique in one non-randomized study.

It is important to note that technique of FED is not standardized and considerable variation exists in clinical practice. In addition, majority of the studies did not use a standardized definition to classify the adverse events. Therefore, it may not be feasible to compare the incidences of adverse events in different studies.

New Devices for Flexible Endoscopic Diverticulotomy

Majority of the studies have reported the use of needle knife or hook knife for diverticulotomy (Fig. 3A, 3C). More recently, the use of scissor type knives has been described for FED. These include the Clutch Cutter knife (CC knife; Fujifilm Co., Tokyo, Japan) and the Stag Beetle knife (SB knife; Sumitomo Bakelite Co., Tokyo, Japan). The utility of these knives has been demon-

Table 1 Types of Knives and Electrosurgical Settings Used in Studies (Selected)

| Variable                   | Manufacturer                      | Specification                        | Setting                                                                 |
|----------------------------|-----------------------------------|--------------------------------------|-------------------------------------------------------------------------|
| Needle knife               | Endo-Flex (Voerde, Germany)       | Length: 1.8 mm                       | Endocut I mode, effect 3, 100 W cutting, 40 W coagulation Auto cut effect 4 |
| Hook knife                 | KD-620 LR; Olympus, Tokyo, Japan  | Length: 4.5 mm; diameter: 0.4 mm;    | Endocut, effect 2, duration 2, interval 3, and forced coagulation effect 2, power 40 W |
|                            |                                    | hook length: 1.3 mm                   |                                                                         |
| Clutch Cutter knife        | Fujifilm Co., Tokyo, Japan         | 0.4 × 3.5 or 5 mm                     | Forced coagulation 30 W, Endo Cut Q with effect 1, duration 3, interval 1 |
| Stag Beetle (SB) knife     | Sumitomo Bakelite Co., Tokyo, Japan| SB: 7 mm; SB Jr: 3.5 mm               | Endo Cut Q Effect 1 Soft Coagulation 40 W                                |
| Triangular tip knife       | KD-645L; Olympus, Tokyo, Japan     | 4.5 × 0.4 mm                          | Diverticulotomy: Spray Coag, effect 2, 40 W Coagulation: Soft Coag, effect 5, 80 W |

Fig. 3. Electrosurgical knives utilized for Zenker’s diverticulotomy. (A) Needle knife Endo-Flex (Voerde, Germany). (B) Stag Beetle knife (Sumitomo Bakelite Co., Tokyo, Japan). (C) Hook knife (used with permission, courtesy of Olympus, Tokyo, Japan). (D) Clutch Cutter knife (Fujifilm Co., Tokyo, Japan). (E) Triangular tip knife (Olympus, Tokyo, Japan).
Fig. 4. Technique of flexible endoscopic diverticulotomy using a triangular tip knife. (A) Endoscopic visualization of the septum. (B) Mucosal incision over the diverticular septum after placement of a soft diverticuloscope. (C) Myotomy of the septum till few millimeters above the lower end of the septum. (D) Placement of an endoclip after completion of the myotomy.

Table 2  Selected Studies Reporting the Outcomes of Flexible Endoscopic Myotomy in Zenker’s Diverticulum

| Study                  | Number | Age (yr)* | Size (cm)* | Knife                  | Procedure time (min)* | Adverse event† | Recurrence/success† | Follow-up (mo)* |
|------------------------|--------|-----------|------------|------------------------|------------------------|---------------|---------------------|-----------------|
| Vogelsang et al (2007) | 31     | 69 (52–92) | 3.7        | Needle knife           | NR                     | 23% (minor)   | Recurrence: 39% (single treatment) | 26 (14–49)     |
| Al-Kadi et al (2010)   | 18     | 80 (68–91) | NR         | Needle knife           | 28.4 (10–60)           | 1 (microperforation) | Recurrence: 2 | 27.5 (0.5–84)  |
| Repici et al (2010)    | 32     | 74.8      | < 3: 6     | Hook knife             | 28 (22–45)             | 6.25%         | Success: 90.6%       | 23.87 ± 9.6    |
| Case and Baron (2010)  | 22     | 84.5 (59–96) | NR         | Needle knife           | NR                     | 27% (perforation) | Success: 82% | 12.7 ± 9.2    |
| Huberty et al (2013)   | 150    | 73 (42–94) | 3 (1–8)    | Needle knife           | NR                     | 2.2%          | Recurrence: 23.1%    | 43 (13–121)    |
| Battaglia et al (2015) | 31     | 71 (52–85) | 3 (1–8)    | Stag Beetle (SB) knife | 14 (11–23)             | 1 (bleeding)  | Recurrence: 2       | 7 (2–18)       |
| Halland et al (2016)   | 52     | 77 (34–97) | 2.8 (1–5)  | Needle knife and Hook knife | NR                 | Mild: 16% Moderate: 2% Severe: 2% | Recurrence: 23% | 26 (0.5–68)    |
| Brueckner et al (2016) | 46     | 67 (40–85) | NR         | Hook knife             | NR                     | Bleeding: 3 Emphysema: 1 | Recurrence: 30% | 39 (18–73)     |
| Costamagna et al (2016)| 89     | 70 (42–94) | 3.0 (1.5–11) | Needle knife           | 15 (7–45)             | Perforation: 2% Bleeding: 1% | Recurrence: 36% | 32 (1–98)      |
| Goeller et al (2016)   | 52     | 71 (42–86) | 3 (1–5)    | SB knife               | 32 (18–60)            | No major complication | Success: 90% (single session) | 16 (2–31)     |
| Pescaruso et al (2016) | 26     | 74.9 (47.3–96.7) | 2.8 (1–5) | Needle or Hook knife | 68 (28–149)           | Leak: 1 patient | Recurrence: 11.5%   | 21.8 (1–68.2)  |
| Djibeyaz et al (2017)  | 17     | 65.3      | 3.2 (2–5)  | Needle knife           | NR                     | 17.6%         | Recurrence: 23.5%    | 47.7 (14–104)  |
| Rath et al (2018)      | 21     | 74.9 (47.3–96.7) | 1.5–5.6  | Clutch Cutter Needle knife | 19 (CC)            | Minor bleed: 1 Delayed bleed: 1 Cervical emphysema: 3 | Recurrence: 1 | 12             |
| Fan et al (2019)       | 9      | 77 (66–85) | NR         | Needle knife           | 36 (14–65)            | None          | Recurrence: 7       | 11 (2–46)      |
| Diez Redondo et al (2019)| 69     | 73.4 (46–93) | 2.8 (1–5) | Ligasure               | 22 (11–48)            | Microperforation: 2.5 Delayed bleed: 1.3 | Success: 84% | 34.6 (24–64)  |

CC, clutch cutter; NK, needle knife; NR, not reported.
*Values are presented as median [range] or mean only unless otherwise indicated.
†Values are presented as percent or number.
strated in endoscopic submucosal dissection for early gastrointestinal neoplasms.

CC knife has monopolar blades and serrated cutting edges (Fig. 3D). The outer surface is insulated which avoids collateral thermal injury. This knife is rotatable and available in two sizes i.e., 3.5 mm and 5.0 mm. Rath et al. described the use of CC knife in six cases with symptomatic ZD. The procedure could be successfully completed in all the patients and there were no major complications. Importantly, the mean procedure duration was only 19 minutes with CC knife as compared to 43 minutes in the needle knife group.

SB knife is similar to the CC knife in terms of monopolar blades and external insulation (Fig. 3B). Currently, three types of SB knives are available i.e., SB knife (standard: 7 mm, short: 6 mm), SB Jr (3.5 mm), and SB GX (6 mm). The latter has partially serrated edges. As compared to CC knife, these knives are slimmer and do not have serrated edges (SB and SB Jr). Several recent studies have described the use of this knife in cricopharyngeal diverticulotomy. Goelder et al. performed diverticulotomy in fifty two patients with ZD (mean size: 3 cm). There were no major complications and majority (90%) of the patients required a single session of myotomy. The proposed advantages of scissor type knives include precise control over the depth of cutting and coagulation using the same device.

Our group recently described the use of a triangular knife (Triangle tip knife J, KD-645L; Olympus, Tokyo, Japan) in the flexible endoscopic treatment of ZD (Fig. 3E). Triangular knife has been primarily utilized for submucosal tunneling procedures like per-oral endoscopic myotomy (POEM) in patients with achalasia cardia. The cutting knife length and diameter are 4.5 × 0.4 mm. While, the length and thickness of triangular tip are 0.4 mm and 0.3 mm, respectively. This knife has L-shaped hook in three directions which avoids the need to rotate the knife and enables quick division of muscle fibers. While using this knife, the median procedure duration was only 12 minutes (8–16 minutes) in our study.

**Novel Techniques for Flexible Endoscopic Diverticulotomy**

The main drawback of conventional FED is high incidence of symptom recurrences on follow-up. In an attempt to improve the outcomes of FED, several new techniques have been evaluated recently. In the following section, we briefly discuss some of these innovations in the flexible endoscopic management of ZD (Table 3).

| Study          | Number | Size (mm)* | Technique                          | Procedure time (min)* | Success/recurrence† | Follow-up*   |
|----------------|--------|------------|------------------------------------|------------------------|---------------------|--------------|
| Gölder et al (2018) | 16     | 20 (5–40) | Double incision and snare resection | 28 (20–47)            | Recurrence: 1       | 3 mo (1–15 mo) |
| Pang et al (2019)  | 20     | 38         | Double incision and snare resection | 56                     | No recurrence       | 19.1 mo      |
| Yang et al (2020)  | 75     | 31.3 (10–89)| Z-POEM/STESD                       | 52.4                   | Recurrence: 3.2%    | 291.5 days   |
| Repici et al (2020) | 20      | 17.5       | Z-POEM                             | 13.8                   | No recurrence       | 12 mo (6–20 mo) |

Z-POEM, Zenker’s per-oral endoscopic myotomy; STESD, submucosal tunneling endoscopic submucosal dissection.

*Values are presented as median (range) or mean only.

†Values are presented as number or percent.

**Fig. 5.** Cartoon representing technical difference between conventional diverticulotomy with double incision and snare resection technique.
Double Incision and Snare Resection Technique

In an attempt to reduce recurrence, Gölder et al.\textsuperscript{32} described a novel technique involving double incision followed by snare resection in sixteen patients with symptomatic ZD. This technique involves parallel incisions with a needle knife or hook knife followed by excision of the cricopharyngeal muscle using a snare (Fig. 5). With this technique, the authors reported only one recurrence at a median follow-up of 3 months. However, small number of patients and a short follow-up duration were the main drawbacks of the study. In a more recent study, Pang et al.\textsuperscript{33} reported the twenty cases with this technique and compared the outcomes with 44 cases in whom the traditional technique of myotomy was utilized. On follow-up, no recurrences were noticed in the myectomy group as compared to a recurrence rate of 22.7% in the standard FED group. There was no significant difference in the procedure duration or rate of adverse events between the two groups.\textsuperscript{33} The proposed advantage of this technique is that by establishing a wider communication between the diverticulum and the esophageal lumen chances of delayed recurrences are minimized. Given the excellent outcomes and safety profile of this technique, long-term follow-up studies and randomized comparison with the established techniques are warranted.

Submucosal Tunneling with Endoscopic Septal Division

Submucosal tunneling technique or third space endoscopy has been widely utilized for various indications including achalasia cardia, sub-epithelial tumors, esophageal epiphrenic diverticulum, and refractory gastroparesis.\textsuperscript{34} More recently, submucosal tunneling has been reported in the management of ZD.\textsuperscript{35–39} This technique, also called as Z-POEM or submucosal tunneling endoscopic septal division, is essentially similar to the one used for achalasia cardia and epiphrenic esophageal diverticulum.\textsuperscript{39} Initially a mucosal bleb is created 1–2 cm proximal to the cricopharyngeal septum using indigocarmine diluted with saline (Fig. 6A, 6B). Alternatively, the mucosal bleb and incision can be created directly above the septum in cases with difficult anatomy.\textsuperscript{39,40} Subsequently, a small mucosal incision is made and submucosal tunnel created (Fig. 6C). Once the septum is reached, the submucosal tunnel is extended towards both the sides of the septum (Fig. 6D). A myotomy is then performed till the distal extent of septum. Finally, the mucosal incision is closed with standard endoclips (Fig. 6F). The proposed advantage of this technique is reduced chances of recurrence due to complete division of the septum. A recent multicenter, retrospective study reported the outcomes of Z-POEM in 75 patients with ZD.\textsuperscript{41} The mean size of the diverticulum was 31.3 ± 1.6 mm (range, 10–89 mm). Technical and clinical success were recorded in 97.3% and 92% of patients, respectively. Adverse events including bleeding and perforation were uncommon and occurred in 6.7% patients.\textsuperscript{41} In another study, Repici et al.\textsuperscript{42} evaluated the outcome of endoscopic septotomy in twenty patients with short septum (≤ 20 mm) ZD. Technical and clinical success were 100% and 95%, respectively. There were no adverse events. While, this technique appears promising, the long-term results and comparison with standard technique of diverticulotomy remain to be seen. In addition, this technique may be difficult in patients with recurrent symptoms after prior FED due to submucosal fibrosis.

Summary

FED is the preferred treatment for the treatment of symptomatic ZD in the current era. The procedure of FED involves the

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**Fig. 6.** Technique of submucosal tunneling endoscopic division of septum. (A) Diverticulum in upper esophagus. (B) Submucosal lifting injection. (C) Mucosal incision. (D) Submucosal dissection along both sides of septum. (E) Division of septum till the lower end of septum. (F) Closure of mucosal incision with multiple endoclips.
division of cricopharyngeal septum using an electrosurgical knife. However, the technique of FED is not standardized and variations exist among different centers. Regardless of the technique or devices used, FED has been shown to be a safe and efficacious treatment for ZD. Recurrence of symptoms is the ‘Achilles heel’ of FED. Recent innovations in the devices as well as the techniques are likely to improve the outcomes of FED. Comparison of the newly available knives and techniques are required before concluding their superiority over the conventional methods of FED (Table 4).

Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

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References

1. Law R, Katzka DA, Baron TH. Zenker's diverticulum. Clin Gastroenterol Hepatol. 2014;12:1773-82; quiz e111-2.
2. Ishaq S, Sultan H, Siau K, Kwasui T, Mulder CJ, Neumann H. New and emerging techniques for endoscopic treatment of Zenker's diverticulum: state-of-the-art review. Dig Endosc. 2018;30:449-60.
3. Albers DV, Kondo A, Bernardo WM, Sakai P, Moura RN, Silva GL, et al. Endoscopic versus surgical approach in the treatment of Zenker's diverticulum: systematic review and meta-analysis. Endoscopy. 2016;48:E578-86.
4. Vogelsang A, Preiss C, Neuhaus H, Schumacher B. Endotherapy of Zenker's diverticulum using the needle-knife technique: long-term follow-up. Endoscopy. 2007;39:131-6.
5. Al-Kadi AS, Maghnhabi AA, Thomson D, Gillman LM, Dhalia S. Endoscopic treatment of Zenker diverticulum: results of a 7-year experience. J Am Coll Surg. 2010;211:239-43.
6. Repici A, Pagano N, Romeo F, Danese S, Arosio M, Rando G, et al. Flexible endoscopic controlled stapler technique for the treatment of Zenker's diverticulum: a case series. World J Gastroenterol. 2017;23:3084-9.
7. Ishaq S, Hassan C, Antenell A, Tanner K, Bellisario C, Battaglia G, et al. Flexible endoscopic controlled stapler technique for the treatment of Zenker's diverticulum: a systematic review and meta-analysis. Gastrointest Endosc. 2016;83:1076-80.
8. Jain D, Sharma A, Shah M, Patel U, Thosani N, Singhal S. Efficacy and safety of flexible endoscopic management of Zenker's diverticulum. J Gastroenterol. 2018;52:369-85.
9. Bresteanu C, Barret M, Guilamaout MA, Abou Ali E, Belle A, Leblanc S, et al. Do we still need a diverticuloscope for the flexible endoscopic septotomy of Zenker's diverticulum? J Gastrointest Endosc. 2019. doi: 10.1111/jgh.14923. [Epub ahead of print]
10. Costamagna G, Iacopini F, Tringali A, Marchese M, Spada C, Familiari P, et al. New endoscopic controlled stapler technique for the treatment of Zenker's diverticulum: results from a single-center experience. Surg Laparosc Endosc Percutan Tech. 2017;27:e136-40.
11. Ramchandani M, Nageshwar Reddy D. New endoscopic "scissors" to treat Zenker's diverticulum. Gastrointest Endosc. 2016;83:765-73.
12. Goelder SK, Brecuecker J, Messmann H. Endoscopic treatment of Zenker's diverticulum with the stag beetle knife (SB Knife) - feasibility and follow-up. Scand J Gastroenterol. 2016;51:1154-9.
13. Pescans R, Shalomovitz E, Sharrat AM, Cassera MA, Reavis KM, Dunst CM, et al. Transoral cricomyotomy using a flexible endoscope: technique and clinical outcomes. Surg Endosc. 2016;30:1784-9.
14. Pescans R, Kuzu UB, Parlang E, Saygi I, Ozgur E, Ari D, et al. Endoscopic treatment of the Zenker diverticulum with flexible endoscopic myotomy: a single tertiary center experience. Surg Laparosc Endosc Percutan Tech. 2017;27:e136-40.
15. Rathi T, Siebler J, Neugut MI, Nagel A. Treatment of Zenker's diverticulum using a novel grasping-type scissors forces allows fast, safe, and effective endoscopic diverticuloscopy. Endosc Int Open. 2018;6:E659-63.
16. Fan HS, Stavert B, Chan DL, Talbot ML. Management of Zenker's diverticulum using flexible endoscopy. VideoGIE. 2019;4:87-90.
17. Diez Redondo P, Nuñez Rodriguez H, de Benito Sanz M, Torres Yuste R, Perez-Miranda E, Montes de Oca A. Endoscopic management of Zenker's diverticulum with LigaSure: simple, safe and effective. Endosc Int Open. 2019;7:E203-8.
18. Pugliese F, Dinocori L, Forgione A, Forti E, Cintolo M, Mutignani M. Cricopharyngeal myotomy with flexible endoscope for Zenker's diverticulum using hook knife and endoclips (with video describing an objective measurement of the cutting length). Endoscopy. 2018;51:122-6.
19. Ishaq S, Falcó S, Cordruewich W, Oldhauer KJ, Baumback R. New flexible endoscopic controlled stapler technique for the treatment of Zenker's diverticulum. Scand J Gastroenterol. 2015;50:1512-5.
20. Hondo FY, Maluf-Filho F, Giordano-Nappi BH, Neves CZ, Cesconello I, Sakai P. Endoscopic treatment of Zenker's diverticulum by harmonic scalpel. Gastrointest Endosc. 2011;74:666-71.
21. Wittsien J, Baumbach R, Stüker D, Weingart V, Nesor F, Gölder SK, et al. New flexible endoscopic controlled stapler technique for the treatment of Zenker's diverticulum: a case series. World J Gastroenterol. 2017;23:3084-9.
22. Ishaq S, Hassan C, Antenell A, Tanner K, Bellisario C, Battaglia G, et al. Flexible endoscopic management of Zenker's diverticulum: a systematic review and meta-analysis. Gastrointest Endosc. 2016;83:1076-80.
23. Jain D, Sharma A, Shah M, Patel U, Thosani N, Singhal S. Efficacy and safety of flexible endoscopic management of Zenker's diverticulum. J Clin Gastroenterol. 2018;52:369-85.
24. Bresteanu C, Barret M, Guilamaout MA, Abou Ali E, Belle A, Leblanc S, et al. Do we still need a diverticuloscope for the flexible endoscopic septotomy of Zenker's diverticulum? J Gastrointest Endosc. 2019. doi: 10.1111/jgh.14923. [Epub ahead of print]
25. Costamagna G, Iacopini F, Tringali A, Marchese M, Spada C, Familiari P, et al. New endoscopic controlled stapler technique for the treatment of Zenker's diverticulum: results from a single-center experience. Surg Laparosc Endosc Percutan Tech. 2017;27:e136-40.
26. Ramchandani M, Nageshwar Reddy D. New endoscopic "scissors" to treat Zenker's diverticulum (with video). Gastrointest Endosc. 2013;78:645-8.
27. Gómez Outomuro A, González-Bermejo O, Pérez-Martínez I, Casal-García A, Rodríguez-Escaja C, Francisco R, et al. Efficacy and safety of the SB Knife™ Jr. for the treatment of Zenker's diverticulum: a case series. Rev Esp Enferm Digest. 2020;112:216-8.
28. Yoshida N, Dohi O, Inoue K, Yasuda R, Ishida T, Hirose R, et al. Efficacy of scissors-type knives for endoscopic mucosal dissection of superficial gastrointestinal neoplasms. Dig Endosc. 2020;32:4-15.
29. Nabi Z, Ramchandani M, Jagtap N, Dariessy S, Reddy DN. Endoscopic treatment of Zenker's diverticulum using a new triangle tip knife. Ann Gastroenterol. 2019;32:650-3.
30. Nabi Z, Ramchandani M, Chavan R, Kalapala R, Darisetty S, Rao GV, et al. Peroral endoscopic myotomy for achalasia cardia: outcomes in over 400 consecutive patients. Endosc Int Open. 2017;5:E311-9.
31. Gölder SK, Brecuecker J, Elighado A, Messmann H. Double incision and snare resection in symptomatic Zenker's diverticulum: a modification of the stag beetle knife technique. Endoscopy. 2018;50:137-41.
ible endoscopic cricopharyngeal myectomy and myotomy approaches for Zenker diverticulum repair. Gastrointest Endosc. 2019;89:880-6.
34. Nabi Z, Nageshwar Reddy D, Ramchandani M, Ramchandani M. Recent advances in third-space endoscopy. Gastroenterol Hepatol (N Y). 2018;14:224–32.
35. Li QL, Chen WF, Zhang XC, Cai MY, Zhang YQ, Hu JW, et al. Submucosal tunneling endoscopic septum division: a novel technique for treating Zenker’s diverticulum. Gastroenterology. 2016;151:1071–4.
36. Hernández Mondragón OV, Solórzano Pineda M0, Blancas Valencia JM. Zenker’s diverticulum: submucosal tunneling endoscopic septum division (Z-POEM). Dig Endosc. 2018;30:124.
37. Brieau B, Leblanc S, Bordacahar B, Barret M, Coriat R, Prat F, et al. Submucosal tunneling endoscopic septum division for Zenker’s diverticulum: a reproducible procedure for endoscopists who perform peroral endoscopic myotomy. Endoscopy. 2018;49:133–4.
38. Hajifathalian K, Dawod Q, Saumoy M, Kahaleh M. Submucosal tunneling endoscopic septum division for treatment of Zenker’s diverticulum. Endoscopy. 2018;50:E340-1.
39. Brewer Gutierrez OI, Ichkhanian Y, Spadaccini M, Vosoughi K, Repici A, Khashab MA. Zenker’s diverticulum per-oral endoscopic myotomy techniques: changing paradigms. Gastroenterology. 2019;156:2134–5.
40. Mavrogenis G, Tsevgas I, Zachariadis D, Bazergahci F. Mucosotomy at the top of the septum facilitates tunneling and clipping during peroral endoscopic myotomy for Zenker’s diverticulum (Z-POEM). Ann Gastroenterol. 2020;33:101.
41. Yang J, Novak S, Ujiki M, Hernández O, Desai P, Benias P, et al. An international study on the use of peroral endoscopic myotomy in the management of Zenker’s diverticulum. Gastrointest Endosc. 2020;91:163–6.
42. Repici A, Spadaccini M, Belletrutti PJ, Galtieri PA, Fugazza A, Anderloni A, et al. Peroral endoscopic septotomy for short-septum Zenker’s diverticulum. Endoscopy. 2020. doi: 10.1055/a-1127-3304. [Epub ahead of print]