ORIGINAL PAPER

DOI: http://dx.doi.org/10.15403/jgld.2014.1121.273.zen

Flexible Endoscopic Treatment for Zenker's Diverticulum – Experience on 31 Patients

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Received: 23.05.2018
Accepted: 14.08.2018

ABSTRACT

Background & Aims: The aim of this study is to present the experience of our center over the last 8 years in a series of patients with Zenker's diverticulum (ZD), treated using an endoscopic, minimally invasive procedure.
Methods: We retrospectively included 31 patients with a previously established diagnosis of ZD based on endoscopic and oral contrast examinations. Patients' age, comorbidities, size of the diverticulum or previous endoscopic treatment were not considered exclusion criteria. A soft, flexible diverticuloscope to expose the septum and a dual knife for "cutting" the diverticular septum were used. We analyzed the short term efficacy based on symptomatic relief and occurrence of side effects, and long term efficiency at 6 and 12 months by clinical assessment, upper gastrointestinal endoscopy and oral contrast media passage.
Results: Patients had a mean age of 67 years (range 42-86); 55% of them were male. All patients reported symptom relief after the procedure. A decrease of more than 70% from the initial size of the diverticulum was noted. There were 3 cases (9.67%) of intraprocedural hemorrhage, endoscopically managed. No serious post-procedural complications and no mortality were reported. The mean procedural time was 21.87 minutes (range 15-25 minutes). Average hospitalization was 2.5 days. Five patients developed recurrence and needed a second session of endoscopic treatment for achieving complete myotomy.
Conclusions: Endoscopic management for ZD was efficient and safe in our series of patients. A short hospitalization period was required.

Key words: esophageal diverticulum – Zenker – diverticulotomy – endoscopic treatment.

Abbreviations: ZD: Zenker diverticulum; Z-POEM: Zenker's per oral endoscopic myotomy.

INTRODUCTION

Zenker's diverticulum (ZD) is a pulsion diverticulum that arises through a dehiscence at Killian's triangle between the oblique and transverse fibers of the inferior pharyngeal constrictor muscle. The transverse fibers are also called the cricopharyngeus muscle, which is the primary muscle comprising the upper esophageal sphincter. Although ZD is a rare and benign condition, it can have an important impact on patients' quality of life. It appears to be most commonly found in middle-aged and elderly men [1, 2]. The main symptoms are dysphagia and regurgitations, due to the impaction of food inside the diverticulum, which can spontaneously dislodge and reappear in the mouth. There is a risk of aspiration, which in turn can lead to recurrent episodes of pneumonia.

Treatment is recommended when patients are symptomatic and implies sectioning the cricopharyngeal muscle fibers. Management has significantly changed during the past decades. While in the 1970s the sole form of intervention was surgical diverticulectomy with cricopharyngealmyotomy, nowadays the endoscopic management of ZD has been found to be a viable safe and effective alternative to surgery, which has gained widespread acceptance [3-5]. The efficacy of different surgical techniques performed for ZD (diverticulectomy, diverticulopexy, diverticular inversion and myotomy alone) [6] ranges between 80% to 100% [7-9]. The mortality and morbidity rates of surgical intervention are significant (mortality rate 0-2.3% and morbidity rate 2.5-46%), mainly due to advanced age and comorbidities of the patients and also due to the intra- or post-procedural complications [6].

Endoscopic treatment is very well tolerated by the patients. It is associated with a short hospitalization, with an average of 2 days, and reduced patient discomfort. Patients are also able to resume oral food intake the day after endoscopic treatment. The overall morbidity and mortality rate for the endoscopic approach were 8.7% and 0.2% [6]. Adverse events of endoscopic therapy include perforation, bleeding and aspiration, which are rarely encountered, but even then are easily manageable. Thus, the overall benefit of treating ZD by endoscopy as opposed to surgery is very high [4, 5].

We present our experience on a series of patients diagnosed with ZD who underwent endoscopic treatment. We analyzed the procedural time, intraprocedural and immediate side effects, time of hospitaliztion and short and long term efficacy of the endoscopic technique.

METHODS

From January 2010 to January 2018, 31 patients were admitted to our hospital with a diagnosis of ZD, previously established based on endoscopic (Fig. 1) and oral contrast examinations (Fig. 2). Patients' age, comorbidities, size of the diverticulum or previous endoscopic treatment were not considered exclusion criteria.

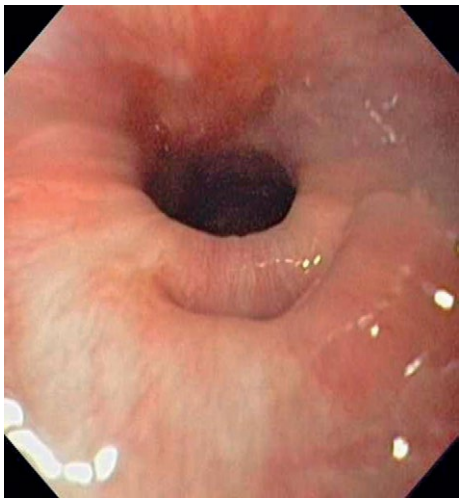

Fig. 1. Endoscopic view of Zenker diverticulum.

After the informed consent was signed, all procedures were performed by a single highly-experienced endoscopist, using carbon-dioxide insufflation, under conscious sedation without orotracheal intubation, monitored by an anesthesiologist. Before the procedure all patients received antibiotic prophylaxis, as a single-dose (1g) of i.v. Ceftriaxone. No oral intake was allowed for 4 hours following the procedure, and the patients received 2 doses of 40 mg proton pump inhibitors (Pantoprazole) at an interval of 12 hours.

With the patients placed in a left lateral position, the procedure was initiated by performing upper gastrointestinal endoscopy in order to evaluate the approach to the diverticulotomy. An Olympus GIF-HQ190 gastroscope (Olympus Co., Japan) was used in all patients. In order to expose the septum we used a soft, flexible diverticuloscope (Cook Medical, Indiana, USA) which was placed over the endoscope and advanced to 20 cm from the incisors (Fig. 3a), with the short blade placed into the diverticulum and the long blade into the esophagus. After the septum was exposed and under endoscopic view, we started cutting the diverticular septum using a Dual Knife (Olympus Co., Japan, with the following electrocautery settings: Endocut I mode, effect 1, Softcoag effect 2; - VIO 300; ERBE Tuebingen, Germany). The incision was performed on the midline, from the esophageal lumen toward the diverticular pouch, with a medium length of 1.5 cm (Fig. 3a). At the end of the procedure a mucosal closure was carried out with endoscopic metallic clips (2-5 clips). Four hours after the procedure, the patients were allowed liquids.

On the first day after the procedure, a contrast media passage of the esophagus was performed, to evaluate the size of the remaining diverticulum sac. Oral refeeding was permitted after the radiologic examination.

Procedural time, intraprocedural and immediate side effects, and time of hospitalization were analyzed.

RESULTS

The patients had a mean age of 67 years (range 42-86), 55% of them being male. All patients had dysphagia, while only half of them described regurgitation. Other less common symptoms were weight loss (12.90%), heartburn (12.90%), dysphonia

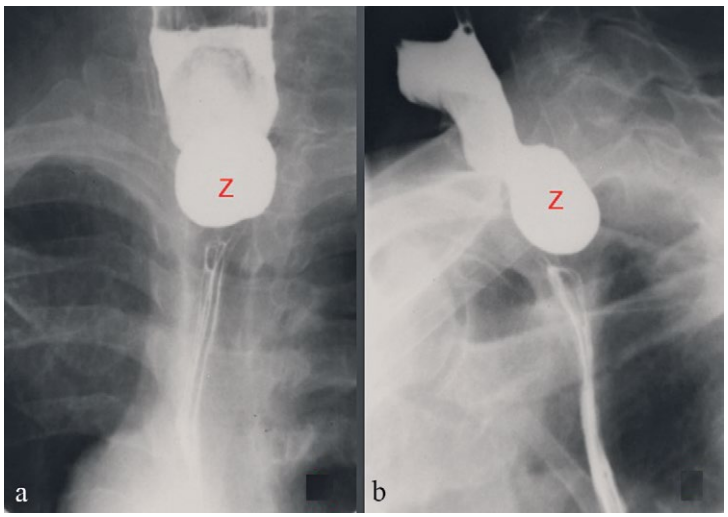

Fig. 2. Esophageal contrast media passage. a. Postero-anterior view. b. Lateral view.

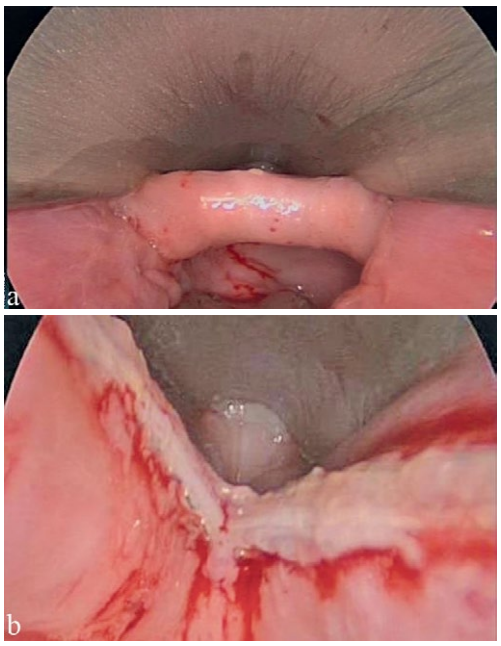

Fig. 3. a. Upper GI endoscopy showing the diverticular septum inside the flexible diverticuloscope. b. Endoscopic view of diverticular septum after the endoscopic cutting.

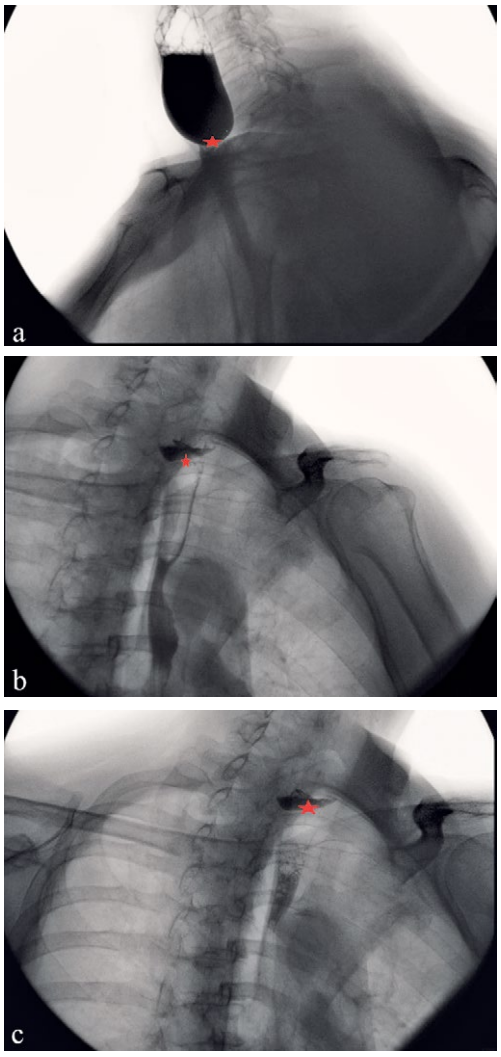

Fig. 4. a. Esophageal contrast media passage lateral view with an "air-fluid-level" in the upper esophagus, showing the ZD before the myotomy; b. c. Oblique view showing the reduction in size of the diverticulum after the myotomy.

(9.67%), and retrosternal pain (9.67%). The mean size of the diverticulum was 3.5 cm (range 2-7 cm).

One single technique was used: endoscopic diverticuloscope-assisted Dual-Knife diverticulotomy. The mucosal closure was carried out with metallic clips (median 3.5, range 2-5). The mean procedure time was 21.87 minutes (range 15-25 minutes). There were 3 cases (9.67%) of intraprocedural laminar hemorrhage which were endoscopically managed by either injecting dilute epinephrine in a concentration of 1:10000 (2 cases) or placing metallic clips (1 case).

No signs of perforation or aspiration pneumonia were observed. No serious post-procedural complications and no mortality were reported.

From the initial size (Fig. 4a) a decrease of more than 70 % (Fig. 4 b, c) of the diverticulum was observed at 24 hours in all cases. No dysphagia and no regurgitation was noted the day after the procedure.

The time of hospital stay averaged 2.5 days, including the day of the procedure.

Short term efficacy was based on symptom relief and second day radiological evaluation. We evaluated long term efficiency by following-up patients at 6 and 12 months assessing the presence of symptoms and performing upper gastrointestinal endoscopy and contrast media passage.

Five patients (12%) developed recurrence (3 patients at 13 months, 1 patient at 36 months, and 1 patient at 60 months after the procedure) and required a second session of endoscopic treatment. After the second session, complete myotomy was achieved in all cases.

DISCUSSION

Minimally invasive techniques for treating ZD have gained popularity in recent years. The endoscopic procedure evolved over the years, from a rigid endoscope to a flexible one, with different devices for exposing and cutting the septum [10-13].

However, the optimal treatment approach: surgery vs. endoscopy remains debatable. The main indication for surgery is a diverticular size < 3 cm and > 7 cm, in which case outcomes are better than for an endoscopic approach [3, 6, 7]. A recent Romanian study [9] compared the outcomes (reappearance of symptoms) of surgical versus endoscopic treatment and found a better efficacy for the endoscopic approach. Endoscopic approach has higher rate of symptom recurrence, which can be managed with a repeat session [7, 14, 15].

The rigid endoscopic diverticulotomy requires general anesthesia and a supine position with neck overextension. The exposure of diverticulum may be compromised by some anatomic situations (short neck, shorter hyomental distance and higher BMI) or a small diverticulum, circumstances which may require conversion to open surgery [6].

The endoscopic flexible diverticulotomy, first reported in 1995 [13, 14], is performed under conscious sedation and without neck extension. Multiple methods for exposing the

septum are described: guidewires, endoscopic caps, semi-flexible overtubes or nasogastric tubes. Multiple cutting devices can be used: needle-knives, endoscopic submucosal dissection knives, argon plasma coagulation, stag beetle knife, a fully rotatable surgical 5-mm stapler in combination with an ultrathin flexible endoscope. The first cutting device was the needle knife papillotome (Wilson Cook, Bloomington, IN, USA) [8], which applied diathermy to dissect the septum. Its advantages were its low cost and availability, while its disadvantages included difficulty in precise control, with an increase risk of perforation and mediastinitis. The Harmonic scalpel (Ethicon Endo-Surgery, Cincinnati, OH, USA) [8] was used with a diverticuloscope. Its blades operate ultrasonically and have the ability to cut and coagulate tissue at the same time. The Hook knife [8, 16] enables cricopharyngeal muscle fibers to be grasped, pulled upwards, and then cut, leading to a complete myotomy with a minimum perforation risk. The Stag Beetle knife (Sumitomo Bakelite Co., Tokyo, Japan) is a scissor-shaped cutting tool and is often used with a diverticuloscope or cap. It allows the incision to be made from the apex to the base of the septum but with a scissor-like movement, which pulls the muscle fibers towards the endoscope while cutting. In addition, the 360 degrees rotational ability increases therapeutic precision and prevents perforation. The Clutch Cutter knife (Fujifilm, Tokyo, Japan), with a rotatable serrated cutting edge has an insulated outer coating. Its rigid blades allow selective grasping and cutting [8], shortening duration of the procedure and reducing the complications [17].

In our series of patients we used a single technique with a flexible overtube (diverticuloscope), while for the septum cutting we used a Dual-Knife. All our patients experienced symptom relief immediate after the procedure, due to the decreasing size of more than 70% of the diverticulum, and no sign of perforation or mediastinitis were reported.

Laquiere et al. [18] reported that endoscopic diverticuloscope-assisted diverticulotomy with submucosal dissection knives was safe and efficient for symptomatic ZD, between 2 to 10 cm long. The advantage of using Dual-Knife was the precision of tissue cutting, without increasing the risk of perforation.

Costamagna et al. [19] compared the cap-assisted technique to the diverticuloscope-assisted technique and reported that the procedjure time was significantly longer; the complication and recurrence rates were higher (32% vs. 0%) in the cap group. Sakai et al. [20], showed that with an oblique-end hood attached to the tip of the endoscope, incision of ZD was simplified, without recurrence during a follow-up of 12 months. Comparing the flexible needle-knife technique with the rigid stapling technique, similar percentages of symptom relief and complication rates were reported [21]. However, the procedural time was longer in the rigid stapling group [6, 22].

New endoscopic techniques were described using double incision and snare resection [23, 24] or submucosal tunneling and endoscopic septum division (Z-POEM) in a large ZD [25].

The overall morbidity rate for the endoscopic approach was 8.7%, whereas it was10.5% for open surgery [6]. Bleeding, perforation, aspiration, and emphysema are possible intra- or post-procedural complications for both approaches [6, 26]. Our overall related procedure complications rate was slightly lower (9.67%) than the literature data (15%) [6]. As endoscopic approach is a fairly complicated procedure due to the diverticulum location, the operator experience was paramount and most probably had a high impact on procedural outcome and complication rate.

In our study, the length of hospital stay averaged 2.5 days, similar with the literature data, and was shorter than their surgical counterparts [6].

Regarding costs, it was calculated that, while the charges of the operative procedures are roughly equivalent, the total hospital charges are significantly less (3589 $) for the patients treated endoscopically than for those using open surgery (11439 $) [27].

The long-term outcomes are very heterogeneous among studies because of different follow-up periods and different sample sizes. Recurrence rates varied from 0-35% on a 20 months follow-up [6, 27] and the success rate ranged between 63-100% after a single treatment session on a 26-month follow-up [28]. At this point of knowledge, there is no long-term follow-up period clearly established. We chose to actively monitor our patients for a 12 months period after the procedure, and established appointments at 6 and 12 months. After this period, patients were advised to address our team if they experienced clinical recurrence. We observed no recurrence in our 12 months active follow-up period, but recurrences occurred later in 12% of the cases. Our active follow-up period was too short and a longer follow-up is desirable for obtaining more accurate data. More studies are required to establish the best treatment option and follow-up protocol.

CONCLUSIONS

Endoscopic management for ZD was efficient and safe in our experience, and the patients had a reduced hospitalization period. At this point, there are various flexible endoscopic treatment options, leaving the endoscopists the option to choose their favorite technique.

Conflicts of interest: No conflict to declare.

Authors' contribution: A.T., M.T., A.P. and C.T. contributed to the concept and design of the study; A.P., C.T. and A.G. acquired the data; A.P. analyzed the data and drafted the manuscript; A.T., C.T. and M.T. reviewed the manuscript.

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