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Single-Center Evaluation of Clinical Results After Modified Transoral Septotomy

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ABSTRACT

Objective: The standard treatment for Zenker's diverticulum (ZD) is transoral septotomy, which has evolved to include techniques such as septal traction to improve outcomes. This study reports the clinical results from our center using a modified transoral septotomy (MTS).

Methods: From 2023 to 2025, 21 patients with ZD were treated with MTS at our center. A dysphagia screening questionnaire was utilized to assess the frequency and severity of dysphagia and regurgitation. All patients underwent a surgical examination, preoperative endoscopy, and preoperative barium swallow. This prospective study aimed to evaluate the outcomes of MTS in treatment-naïve and recurrent ZD cases, highlighting the technique's appeal due to its minimally invasive nature and enhanced patient outcomes.

Results: Among the 21 patients (16 males, 5 females, median age 82.5 years, interquartile range (IQR): 61–80), symptom scores improved from a median of 12 (IQR: 10–16) pre-surgery to 0 (IQR: 0–2) post-surgery ($p < 0.00001$). Post-procedure, 87% of patients were completely asymptomatic, with a total failure rate of 5%. The treatment was successful in 95% of patients overall and in 100% of those with recurrent ZD.

Conclusion: Despite inherent study limitations, modified transoral septotomy significantly improves treatment outcomes for ZD patients.

Level of Evidence: 2 (observational study with significant effect)—Oxford Centre for Evidence-Based Medicine 2011 Levels of Evidence.

1 | Introduction

Zenker's diverticulum (ZD) is the most common upper gastrointestinal diverticulum, characterized by tissue protrusion through Killian's triangle, primarily due to cricopharyngeal muscle dysfunction [1]. The pathophysiology involves reduced muscle compliance and elevated intrabolus pressure. ZD is rare, affecting 2 per 100,000 people annually, mainly in those over 60 [2, 3]. Symptoms include dysphagia, regurgitation, drooling, and sometimes coughing, which can lead to aspiration pneumonia [2, 4–9].

Surgical interventions like cervicotomy and UES myotomy with diverticulectomy or diverticulopexy were long considered the gold standard. Recently, minimally invasive transoral septotomy using flexible endoscopic techniques has gained traction, though it has high recurrence and complication rates [10, 11]. First described by Collard et al. in 1993, this technique involves the use of a diverticuloscope and stapler to seal and divide the diverticulum and esophagus walls [11]. Its popularity stems from reduced complication rates, shorter procedure times, and brief hospital stays.

The modified transoral septotomy, which includes septal traction to enhance septum exposure and length, has become an effective treatment, particularly for recurrent cases [3, 6, 12]. Given the rarity of ZD and limited literature on MTS, this study aims to showcase the technique's effectiveness in improving outcomes and quality of life for ZD patients, with minimal complications and shorter hospital stays [13].

2 | Methods

We enrolled all consecutive patients diagnosed with naive or recurrent ZD (≥ 2.5 cm) treated with MTS at ASUFC "Santa Maria della Misericordia" between 2023 and 2025. Procedures followed ethical standards and the Helsinki Declaration (2013 revision). Patients consented to publication and accompanying images and the study was approved by our institutional review board.

Patients underwent diagnostic workups and preoperative staging via endoscopy and barium swallow radiographs (Figure 1) to assess mucosal status and rule out tumors. Symptom scoring evaluated dysphagia and food regurgitation [4, 12], with self-assessment of weight loss, drooling, cough, and rumination. Demographic and clinical data were collected.

2.1 | Surgical Technique

The technique, as described [4, 5], was performed with the patients in the supine position and with the neck extended. A Weerda diverticuloscope was inserted. After anatomical evaluation with a 5 mm optical camera (Figure 2), two sutures were placed on the septum for traction (Figure 3). An endoscopic surgical stapler (Endo GIA 30-mm Reload with Tri-Staple Technology, Medtronic) was then used to section the septum (Figure 4). Post-surgery, patients underwent a Gastrografin swallow test (Figure 5); if no leaks were detected, the nasogastric tube was removed and a liquid diet commenced. Patients were discharged on the third postoperative day. Complications were classified using the Clavien-Dindo system.

Follow-up involved examinations 2 months post-surgery, with symptom scoring and barium radiography repeated for recurrent symptoms. Endoscopy was scheduled 16–18 months post-MTS, then biennially. Treatment was deemed unsuccessful if additional procedures were required or postoperative scores exceeded preoperative scores.

Treatment was defined as failure if a patient required an additional procedure for persistent and/or recurrent symptoms and/or when their postoperative survival score was above the 10th percentile of the preoperative score (i.e., >10) [7]. All follow-up

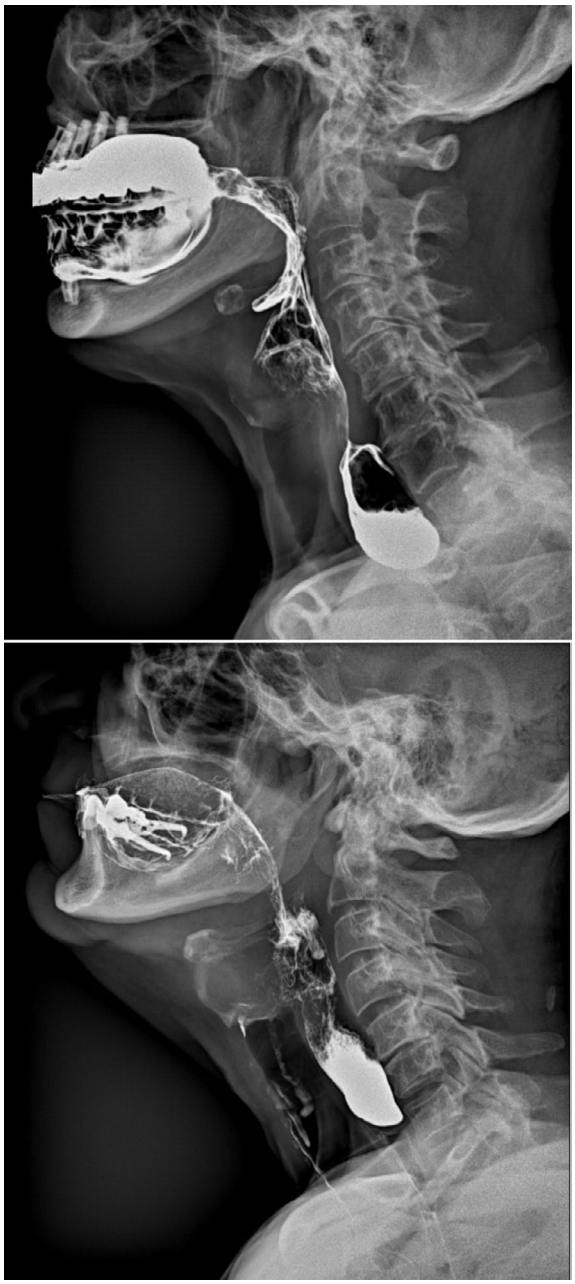

FIGURE 1 | Pre-operative barium swallow X-rays.

procedures were routinely performed as part of the management of patients surgically treated for NZD or RZD.

Success rates were calculated as numbers in relation to the total number of subjects and will be reported with the respective 95% Cis. Continuous data were expressed as medians and interquartile ranges (IQR), ranges, and standard deviations (SD). Changes between pre- and postoperative symptom score were assessed using the Wilcoxon test. A *p*value of less than 0.05 was considered statically significant.

3 | Results

During the study period, 21 consecutive patients were enrolled (16 men and 5 women; median age 82.5 years, IQR 61–80).

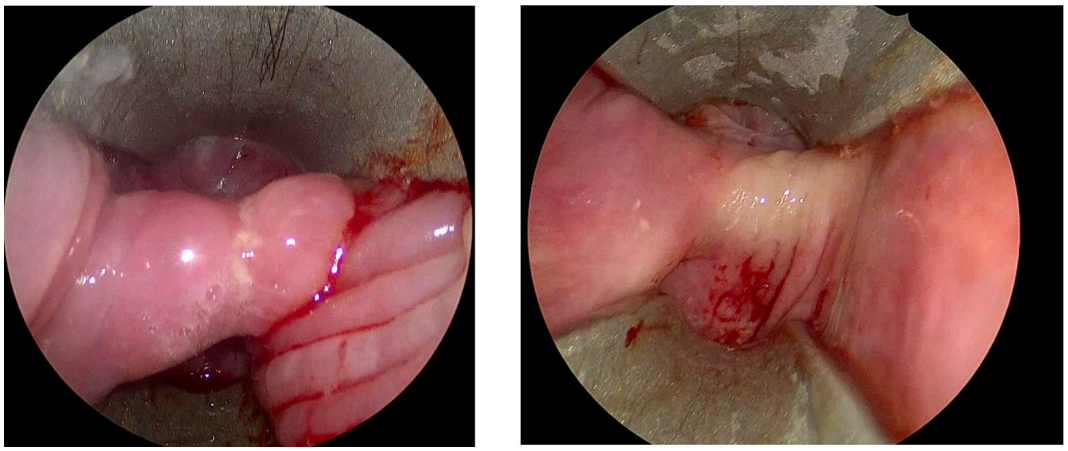

FIGURE 2 | Recurrent and Naïve Zenker's diverticulum.

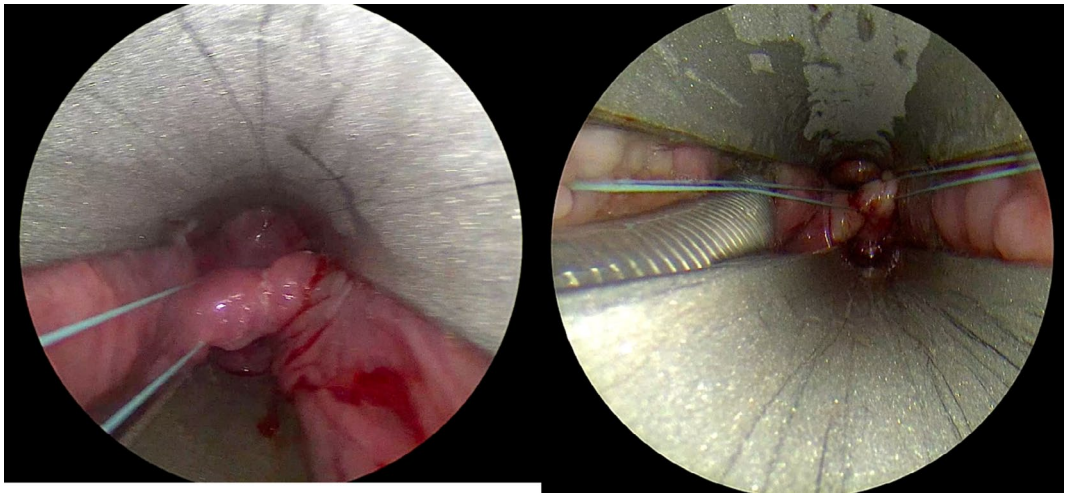

FIGURE 3 | Positioning of Endo Stitch.

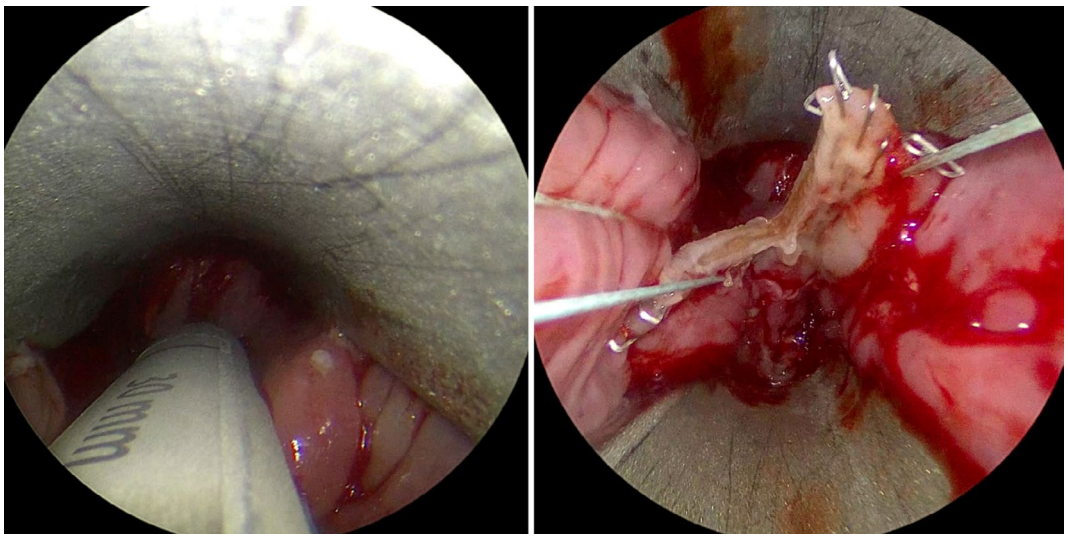

FIGURE 4 | Positioning of Endogia and Section of the septum.

Eighteen patients were diagnosed with NZD and 8 with RZD. All patients underwent modified transoral septotomy with septal traction.

Of the 3 patients diagnosed with recurrent ZD, endoscopic septotomy had been treated elsewhere. Two of these patients had undergone endoscopic septotomy twice.

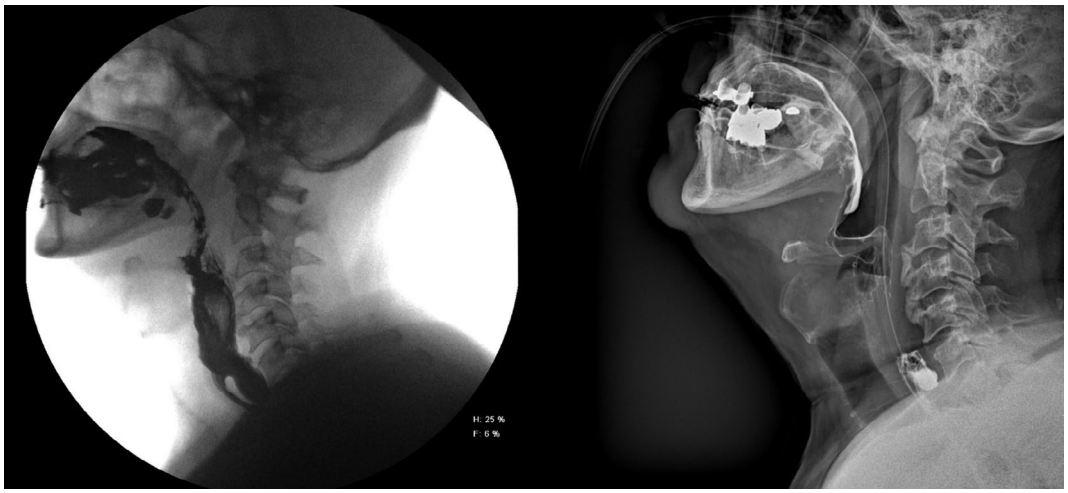

FIGURE 5 | Pre-operative barium swallow X-rays and first day post-operative barium swallow X-rays.

TABLE 1 | Demographic and preoperative data.

NZD:RZD	18:3
Sex (M:F)	16:5
Age (years)	82.5 (IQR: 80–61)
Pre-operative symptom score	12 (IQR: 16–10)
Pouch size (mm)	48.8 (IQR: 55–38)
Septum length (mm)	39.5 (IQR: 44–31.5)

TABLE 2 | Intraoperative and postoperative patient data.

Procedure time (min)	38.5 min (IQR: 43–23)
Median number of staplers	2 (IQR 2–1).
Mucosal lesion	1 (5%)
Other intra-operative complications	0
Post-operative symptom score	0 (IQR 2–0)

Of the 3 patients diagnosed with recurrent ZD, endoscopic septotomy had been performed elsewhere. Two of these patients, to be precise, had undergone endoscopic septotomy twice. All demographic and preoperative data are reported in Table 1. The pre-operative median pouch size was 48.8 mm (IQR 38–55) in the entire study group, while when analyzing the individual groups, the median pouch size was 52 mm (IQR 40–55) in the NZD group and in the RZD group was 47 mm (IQR: 30–65). The preoperative median septum length was 39.5 mm (IQR 31.5–44). The postoperative median septum length was 20 mm (IQR: 14.7–27.5).

The modified septotomy was completed transorally in all patients. The median time to complete the procedure was 38.5 min (IQR: 23–43, range: 20–135, SD: 27.5). The mortality was zero. A mucosal lesion was detected intraoperatively in one patient with NZD, which resulted in conversion with subsequent left cervicotomy, diverticulectomy, and myotomy.

No other mucosal lesions were detected. No tooth avulsion was found in any patient, and no leakage was identified by the Gastrografin swallow radiograph performed on the first postoperative day. In the Table 2 are summarized intraoperative and postoperative patient data.

Number of staple cartridges were used, with a median of 2 cartridges (IQR 1–2).

The median follow-up was 16 months (IQR: 8–24, range: 2–30 months, SD: 19.7).

Patients' SSs dropped from a median 12 (IQR 10–16) before surgery to 0 (IQR 0–2) after surgery ($p < 0.00001$).

All patients had an improvement in their symptom score after the procedure with 87% of patients were completely asymptomatic, but the failure rates were 5% (1 of 21) in total. The treatment was successful in 95% of all patients and in 100% in the patients with RZD.

4 | Discussion

The management of symptomatic ZD in current clinical practice is far from being standardized. Surgical treatment of RZD has for many years focused on myotomy combined with pouch excision, diverticulectomy, or its suspension from the prevertebral fascia, diverticulopexy. This surgical procedure is associated with a 0.9%–1% mortality rate and higher rates of complications such as recurrent nerve palsy and salivary fistula (in 3.4% and 3.7% of patients, respectively) compared to endoscopic surgery [14].

Open surgery has traditionally been considered the gold standard [15], but the experience gained over time and the excellent results obtained with endoscopic and transoral surgical techniques have contributed to a growing interest in their use in the treatment of ZD. It does not require incisions, the procedure is quick, and involves fewer risks for patients than the cervical approach, thus allowing for faster healing and consequently a shorter hospital stay. Currently, the septum can be divided using staplers, CO2 lasers, or harmonic scalpels [16–18].

For both NZD and RZD, postoperative or endoscopic complications with recurrence of symptoms are not uncommon. A recent systematic review found a symptom recurrence rate of 18.9% for stapled diverticulotomy, 21.7% for laser diverticulotomy, and 4.2% after an open transcervical approach [6].

According to literature, open surgical techniques result in symptom relief in over 90% of patients [18–21]. Flexible endoscopic treatment with ZD is also feasible [20]. Patients are positioned in the lateral decubitus position, and the operation is performed under conscious sedation or anesthesia. This type of procedure appears to be particularly indicated for patients unsuitable for general anesthesia or for patients with unfavorable anatomical characteristics or problems related to the positioning of the Weerda diverticuloscope. The standardization of flexible endoscopy for ZD has yet to be established; various cutting techniques may be integrated with a range of accessories, depending on the specific requirements and objectives of the task and the experience and personal preferences of the physicians, with a high rate of recurrence (12%–57%) or symptom improvement lower than the surgical technique and also a high rate of esophageal perforation of up to 18% [22–24]. Until about 5 years ago, the final success rate for transoral septotomy was around 75%–90% [19, 22]. To date, some studies describe how, in our case, patients undergoing MTS achieve a 96.3% success rate [5, 7].

Modified transoral septotomy, adding two traction stitches to the septal apex to lengthen the tissue to be sutured, has already been described, [4, 5, 7, 25] but so far, only a few studies have examined short- and long-term outcomes [25–27].

In recent years, another endoscopic technique, perioral endoscopic myotomy (Z-POEM), has established itself as a minimally invasive option for the treatment of ZD. Some studies have shown promising results, with excellent clinical success [28].

In the current literature, few studies compare the various techniques described, such as Z-POEM with flexible endoscopic septal division (FESD) or MTS. A very interesting study is the one published by Provenzano et al. [28], a multicenter, case-matched comparative study aimed at evaluating whether Z-POEM could be as effective as stapler-assisted transoral septotomy and traction.

Both treatments proved effective. MTS showed a lower rate of intraoperative complications and a shorter operating time.

During follow-up, all patients in our study experienced a decline in symptom scores. In 95% of the patients in our sample, MTS was successful. One of the main limitations of our study is the varying lengths of follow-up. To date, no patients have reported symptom recurrence or a worsening symptom score.

These results are comparable to those reported in other series and confirm that the modified procedure is effective in both the short and long term [25, 29]. The success rate in our sample was slightly higher, likely because of shorter follow-up or perhaps due to careful preoperative patient stratification.

In our center, procedure time, resumption of oral feeding, and length of hospital stay were similar to those reported in the literature. One of our patients required conversion to a cervical approach, resulting in a conversion rate of 5% (while the reported conversion rate in the literature was 7.7%) [30, 31]. All our patients had significantly lower symptom scores after the procedures. Overall, 87% of patients were completely asymptomatic after a single septotomy session.

Our study has limitations, however, due to the small number of cases, but considering the incidence of the disease, we can also conclude that the number of patients is high, as well as the different follow-up patterns. Despite this, and considering the available literature, we can confirm that modified transoral septotomy enhances the final outcome of patients with ZD. We agree with other colleagues [5, 7] that the reason for this lies in the fact that the two sutures allow for "reverse traction" on the septum and consequently, greater exposure of the septum and a more complete section of the UES muscle fibers, thus reducing the risk of recurrence.

In our clinical practice, we have adopted the transoral approach in patients with ZD with a septum ≥ 2.5 cm. Perhaps considering the additional length of tissue to be sutured using two supporting sutures, this technique could also be proposed for patients with a smaller diverticular septum.

5 | Conclusion

ZD is rare and requires treatment in specialized centers. Modified transoral septotomy with septal traction is effective for both naive and recurrent ZD, improving patient outcomes with minimal complications. Despite study limitations, MTS enhances ZD treatment outcomes.

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The authors have nothing to report.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that supports the findings of this study are available in the Supporting Information of this article.

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