Clinics in Surgery

Review Article
Published: 24 Apr, 2017

Zenker's Diverticulum: Endoscopic Surgical Management Options

Frank R Miller* and Christine Taylor

Department of Otolaryngology-Head and Neck Surgery, University of Texas Health Science Center San Antonio, USA

Abstract

Zenker diverticulum (ZD) is an uncommon pharyngo-esophageal outpouching that occurs in an area of muscular weakness at the junction of the inferior aspect of the inferior constrictor muscle and the cricophayngeus muscle (Killian dehiscence). As the diverticlulum enlarges it produces progressive dysphagia, regurgitation, and aspiration. The classic approach has been to do an open diverticulectomy in conjunction with a cricopharyngeal myotomy. While successful, the open approach is associated with significant cost, extended recovery time, and surgical morbidity. More recently the minimally invasive endoscopic diverticulostomy has been advocated as the procedure of choice to manage the majority of patients with ZD. This endoscopic technique consists of a trans-oral surgical procedure that divides the septum (party wall) between the ZD and the cervical esophagus. This mini-review will provide an overview of the current status of the use of the minimally invasive endoscopic technique with particular emphasis on the efficacy of the surgical procedure, safety of the procedure compared to open surgical techniques, and the cost savings associated with the minimally invasive technique.

Introduction

Zenker diverticulum (ZD) is a pharyngo-esophageal diverticulum/outpouching that is typically seen in older patients. Anatomically it is a diverticulum that forms between the inferior constrictor muscle and the cricopharyngeus muscle (upper esophageal sphincter). This area of junctional weakness is known as Killian's triangle and represents an inherently weak region of the pharyngo-esophageal segment [1-8]. It is most commonly diagnosed with a barium swallow study (Figure 1). Symptoms may range from mild globus pharyngeus and dysphagia to severe dysphagia, regurgitation, and aspiration. In severe cases patients may have recurrent pneumonia/bronchitis and have to rely on gastrostomy tube feedings for nutrition. In addition to the inability to safely swallow it can negatively impact quality of life and deprive the patient of the ability to eat by mouth [1-3,8-15].

The pathophysiology of ZD remains unclear but is felt to be secondary to repeated dysfunction between the upper esophageal sphincter (UES) relaxation and pharyngeal contraction during swallowing. This dyscoordination results in a failure of appropriate relaxation of the UES and abnormally high intra-esophageal pressures that lead to the formation of a pseudo-diverticulum [2].

For many years the traditional treatment of ZD consisted of an open surgical approach that typically included a diverticulectomy combined with crico-pharyngeal myotomy. This open surgical approach was very successful but came with some morbidity (and even mortality) particularly in the typical elderly patient. Among the potential complications were recurrent laryngeal nerve injury, pharyngo-cutaneous fistula, and mediastinitis. Mortality rates as high as 2% to 4% have been reported with the open surgical approach [1,2].

Over the past 15+ years there has been a trend toward minimally invasive surgery across a wide variety of surgical procedures. The goal of minimally invasive surgery is to reduce operative time, lower the complications associated with open surgical procedures, and expedite hospital discharge thus reducing overall health care costs [1-24]. This approach has been extended to the management of ZD with a large experience accumulated in the use of endoscopic diverticulostomy to open the diverticulum into the cervical esophagus. In many institutions the minimally invasive approach has emerged as the surgical technique of choice to manage ZD [1,4,6,12]. Several classification systems for Zenker's diverticulum have been proposed including the Brombart and the Morton Bartley systems. The Morton/Bartley system classifies the diverticulum based on size with Stage I

OPEN ACCESS

****Correspondence:***
Frank R Miller, Department of Otolaryngology-Head and Neck Surgery, University of Texas Health Science Center San Antonio, San Antonio, TX 78229, USA. Tel: 210-450-0719;
E-mail: millerfr@uthscsa.edu

Received Date: *08 Feb 2017*
Accepted Date*: 17 Apr 2017*
Published Date*: 24 Apr 2017*

Citation:
Miller FR, Taylor C. Zenker's Diverticulum: Endoscopic Surgical Management Options. Clin Surg. 2017; 2: 1422.

Figure 1: Barium swallows (lateral view) demonstrating classic Zenker diverticulum.

Figure 2: Weerda bi-valve diverticuloscope.

(< 2 cm), Stage II (2-4 cm), and Stage III (>4 cm). Our experience has been that, while helpful, the true assessment of suitability for endoscopic diverticulostomy is best assessed with an exam under anesthesia and an attempt at endoscopic exposure. The key component of the endoscopic approach is the ability to expose the party wall (Cricopharyngeus region) and transect that to the base of the diverticular sac. Even small diverticulum < 2 cm (Stage I) may be amenable to endoscopic diverticulostomy or endoscopic crico-pharyngeal myotomy. In the event that the small diverticulum cannot be managed endoscopically we then consider an open approach for a crico-pharyngeal myotomy. The purpose of this paper is to review the current state of the art of the minimally invasive surgical techniques in the management of ZD.

Current Minimally Invasive Surgical Options

Transoral rigid endoscopy

Over the last 15 years there has been a large experience developed utilizing a minimally invasive technique in the management of ZD. The procedure consists of using a bi-valve diverticuloscope (Weerda bivalve; Karl Storz, Culver City, CA; (Figure 2) to expose the diverticulum and the party wall between the diverticular sac and the esophageal lumen (Figure 3) [1-20]. The concept is to then transect the party wall between the ZD and the esophagus thus creating an open diverticulostomy. The open diverticulostomy is thus prevented from collecting food/debris and often results in significant improvement or resolution of the dysphagia, regurgitation, and aspiration. A variety of tools have been utilized to transect the party wall including the CO_2 laser, the endoscopic linear stapler/cutting device, and more recently the harmonic scalpel. Some reports suggest the endoscopic technique is safer with lower risk of perforation, fistula, and

Figure 3: Endoscopic exposure of Zenker diverticulum sac and party wall between the diverticular sac and the cervical esophagus.

mediastinitis due to the fact that the stapler technique closes off the cut edges [1,2,6,12,14]. The operative technique is done under direct endoscopic visualization with a 0 degree telescope. Numerous papers have been published with all three techniques (CO_2 laser, stapler, and harmonic scalpel) demonstrating excellent results. At this point there has been no controlled study that compares the various party wall cutting tools. The endoscopic stapling device is the most commonly utilized minimally invasive technique and has consistently shown excellent outcome in greater than 90% of surgical cases. Success is generally accessed via swallowing symptom control via surveys that assess resolution of dysphagia, resumption full diet and lack of regurgitation. In England the endoscopic stapling technique is endorsed by the National Institute for Clinical Excellence (NICE). In a review of 585 patients 92.3% underwent endoscopic trans-oral stapling with a success rate of >90%. The overall recurrence rate was 12.8% of which many can undergo a second attempt at endoscopic stapling. Most importantly the endoscopic stapling technique appears to be safe and well tolerated. It has low morbidity, rapid recovery time (typically resume oral intake within 12 to 24 hours), discharge home within 24 hours and low risk of fistula and nerve injury [17].

As noted above the major advantage of the minimally invasive endoscopic technique is the low incidence of major complications. The traditional open surgical approach including diverticulectomy has a higher rate of major complications in 15% to 30% of cases including fistula (6%), recurrent laryngeal nerve injury (4%), mediastinitis (2-3%), and mortality rate of 2%. The overall risk of major complications in endoscopic technique for ZD is in the range of 1%-2% with rare cases of fistula, nerve injury, and mediastinitis [1,4,6,12-16]. Most complications of endoscopic technique are related to inability to expose the diverticular sac and dental injuries [1].

From a quality of life standpoint a number of studies have demonstrated significant improvements in various swallowing parameters. Miller "et al." [1] demonstrated a significant improvement in both dysphagia and regurgitation scores after endoscopic diverticulostomy utilizing both the CO_2 laser and the endoscopic stapler. Overall 86% of the patients demonstrated good oral intake with 24 h and there were no major complications. In a more recent study Bonavina "et al." [19] analyzed 100 patients who underwent trans-oral endoscopic stapling of the ZD. A statistically significant improvement in dysphagia and regurgitation scores ($p< 0.001$) was noted with a median follow-up of over 5 years. In a similar fashion there was a significant decrease in the episodes of pneumonia and the overall success rate was 76%. Most importantly the procedure is

well tolerated and had minimal complications. This study had one of the longer follow-up periods providing evidence that the swallowing improvements are sustainable over time. Another advantage of the endoscopic technique is that it does not limit the surgeon's ability to perform revision endoscopic diverticulostomy in patients who have failed previous endoscopic or open ZD repair. Scher reported a series of 18 patients with recurrent ZD (9 previous endoscopic repair and 9 by open external approach). Despite the previous surgery 16 of the 18 patients (89%) had partial or complete relief of symptoms after endoscopic stapling diverticulostomy with follow-up ranging from 9 to 60 months [10]. In our practice we offer all patients and opportunity for endoscopic ZD repair including patients who have had prior surgical intervention.

In addition to its efficacy in improving the swallowing dysfunction associated with ZD, the endoscopic approach has been associated with shortened hospital stay and significant cost savings. Smith "et al." [15] did a retrospective analysis of 16 patients that underwent surgical management of the ZD (8: Endoscopic diverticulostomy versus 8: standard open diverticulectomy) [15]. They found that compared to the standard open technique, the endoscopic stapling technique demonstrated a shorter operative time, a shorter hospital stay, and a shorter time to resumption of oral intake. The overall total hospital charges were significantly less for the group that underwent endoscopic minimally invasive surgery with the average total hospital charges reduced by approximately 65%. In this era of cost containment these savings are not insignificant.

Rare reports of carcinoma or carcinoma in situ arising from the lining of a ZD have been reported [20]. Overall the risk of carcinoma arising from the ZD has been reported to be less than 1%. It is recommended that the surgeon perform a careful endoscopic examination of the diverticulum prior to any intervention. Any mucosal abnormalities can be biopsied to rule out malignancy. In the rare event a malignancy is identified the surgeon should consider an open traditional diverticulectomy to fully excise the diverticular sac and possible ipsilateral para-tracheal node dissection Adjuvant radiation therapy may be recommended depending on the final pathology.

One of the challenges with the endoscopic minimally invasive technique is that is requires the patient to be put under a general anesthesia. Many of the ZD patients are elderly and have significant co-morbidities thus obtaining anesthesia clearance can be a challenge. This has resulted in an interest in developing techniques with flexible endoscopy that would allow the surgeon to do these procedures under sedation (avoid general anesthesia). The next section will review the state of flexible endoscopy.

Flexible endoscopy

The role of flexible endoscopy is less established in the management of ZD. The concept of utilizing flexible endoscopy arose from the need to try to develop a technique that is minimally invasive yet does not require a general anesthesia [21-23]. There has been an interest by interventional gastroenterologists to develop a technique and the appropriate tools that would allow the endoscopist to perform a diverticulostomy with the patient under sedation. The purported advantage is the avoidance of a general anesthesia in the elderly frail patient. In addition the flexible endoscopic technique could be utilized in patients with anatomy that precludes the use of the traditional rigid endoscopy.

The flexible technique is performed utilizing a standard flexible endoscope and a variety of devices (needle knife, argon plasma coagulation, forceps coagulation, etc.) are utilized to cut the party wall between the diverticulum and the esophagus. The instrument is typically selected by the endoscopist based on training and experience and no studies have compared the instruments regarding safety and efficacy. In a recent review article, Perbtani "et al." [21] reviewed 19 published case series of flexible endoscopy to manage ZD in 670 patients. The majority of these studies were case series with limited objective assessment of swallowing improvement [21]. In addition it appears to be more common that patients may need a subsequent second or third procedure to adequately complete the transection of the diverticular wall. In a case series from the Mayo Clinic 22 consecutive patients were treated using flexible endoscopic techniques [22]. The diverticular wall was transected with a needle knife and electrocautery. Eight of the patients (36%) were hospitalized after the procedure with a mean length of hospitalization of 2.9 days. Perforation was reported in 6 patients (27%). Fourteen of the patients (64%) had no complications. Many of the patients were deemed unsuitable for standard rigid endoscopic management with general anesthesia due to advanced age and serious medical co-morbidities. Overall 15 of the 22 patients (68%) reported complete/near complete symptoms resolution (dysphagia, regurgitation, recurrent pneumonia). The flexible endoscopic technique may be an option in patients who are not candidates for a rigid endoscopic approach. As the technology and experience evolves we may see better equipment that will improve the ability to use flexible endoscopy to manage ZD. In our current practice we utilize rigid endoscopic diverticulostomy in the management of the majority of patients with symptomatic ZD. At this point in time the use of flexible endoscopy is limited in its application.

Conclusion

The use of the minimally invasive rigid endoscopic diverticulostomy to manage patients with ZD is now a proven surgical technique. Over the last 15 years this endoscopic technique has been utilized in hundreds of patients with great success. In our opinion it has replaced the traditional open approach with diverticulectomy as the first line surgical treatment of ZD. The endoscopic approach is safe and effective in over 90% of patients and does not eliminate other treatment options. In addition the endoscopic approach has been demonstrated to lead to shorter operative time, shorter hospital stay, and quicker resumption of oral intake. These factors contribute to a 65% reduction in overall hospital charges when compared to the traditional open surgical approach with diverticulectomy. Quality of life scores as reflected in swallowing improved in 90% of patients.

References

1. Miller FR, Bartley J, Otto RA. The endoscopic management of Zenker diverticulum: CO2 laser versus endoscopic stapling. Laryngoscope. 2006;116:1608-11.
2. Prisman E, Genden EM. Zenker diverticulum. Otolaryngol Clin North Am. 2013;46(6):1101-11.
3. Repici A, Pagano N, Fumagalli U, Peracchia A, Narne S, Malesci A, et al. Transoral treatment of Zenker diverticulum: flexible endoscopy versus endoscopic stapling. A retrospective comparison of outcomes. Dis Esophagus. 2011;24:235-9.
4. Bock JM, Van Daele DJ, Gupta N, Blumin JH. Management of Zenker's diverticulum in the endoscopic age: current practice patterns. Ann Otol Rhinol Laryngol. 2011;120(12):796-806.

5. Peracchia A, Bonavina L, Narne S, Segalin A, Antoniazzi L, Marotta G. Minimally invasive surgery for Zenker diverticulum: analysis of results in 95 consecutive patients. Arch Surg. 1998;133(7):695-700.

6. Cook RD, Huang PC, Richstemeier WJ, Scher RL. Endoscopic staple assisted esophagodiverticulostomy: An excellent treatment of choice for Zenker's diverticulum. Laryngoscope. 2000;110:2020-5.

7. Von Doersten PG, Byl FM. Endoscopic Zenker's diverticulostomy (Dohlman procedure): Forty cases reviewed. Otolaryngol Head Neck Surg. 1997;116:209-12.

8. Thaler ER, Weber RS, Goldberg AN, Weinstein GS, Raut VV, Primrose WJ. Feasibility and outcome of endoscopic staple Long term results of endoscopic stapling diverticulostomy. 2001;111:1506-08.

9. Veenker E, Cohen JI. Current trends in management of Zenker diverticulum. Curr Opin Otolaryngol Head Neck Surg. 2003;11(3):160-5.

10. Scher RL. Endoscopic staple diverticulostomy for recurrent Zenker's diverticulum. Laryngoscope. 2003;113(1):63-7.

11. De Casso C, Lalam M, Ghosh S, Timms M. Endoscopic stapling diverticulotomy: an audit of difficulties, outcome, and patient satisfaction. Otolaryngol Head Neck Surg. 2006;134:288-93.

12. Philippsen LP, Weisberger EC, Whiteman TS, Schmidt JL. Endoscopic stapled diverticulotomy: treatment of choice for Zenker's diverticulum. Laryngoscope. 2000;110(8):1283-6.

13. Raut VV, Primrose WJ. Long-term results of endoscopic stapling diverticulotomy for pharyngeal pouches. Otolaryngol Head Neck Surg. 2002;127(3):225-9.

14. Chang CWD, Burkey BB, Netterville JL, Courey MS, Garrett CG, Bayles SW. Carbon dioxide laser endoscopic diverticulotomy versus open diverticulectomy for Zenker's diverticulum. Laryngoscope. 2004;114:519-27.

15. Smith SR, Genden EM, Urken ML. Endoscopic stapling technique for the treatment of Zenker diverticulum vs standard open-neck technique: a direct comparison and charge analysis. Arch Otolaryngol Head Neck Surg. 2002;128(2):141-4.

16. Whited C, Lee WT, Scher R. Evaluation of endoscopic harmonic diverticulostomy. Laryngoscope. 2012;122(6):1297-300.

17. Leong SC, Wilkie MD, Webb CJ. Impact of endoscopic stapling of Zenker's diverticulum on patient health status as assessed by the Glasgow Benefit Inventory. Ann Otol Rhinol Laryngol. 2012;121(9):576-8.

18. Palmer AD, Herrington HC, Rad IC, Cohen JI. Dysphagia after endoscopic repair of Zenker's diverticulum. Laryngoscope. 2007;117(4):617-22.

19. Bonavina L, Aiolfi A, Scolari F, Bona D, Lovece A, Asti E. Long-term outcome and quality of life after transoral stapling for Zenker diverticulum. World J Gastroenterol. 2015;21(4):1167-72.

20. Acharya A, Jennings S, Douglas S, Mirza S, Beasley N. Carcinoma arising in pharyngeal pouch previously treated by endoscopic stapling. Laryngoscope. 2006;116:1043-5.

21. Perbtani Y, Suarez A, Wagh MS. Techniques and efficacy of flexible endoscopic therapy of Zenker's diverticulum. World J Gastrointest Endosc. 2015;7(3):206-12.

22. Case DJ, Baron TH. Flexible endoscopic management of Zenker diverticulum: the Mayo Clinic experience. Mayo Clin Proc. 2010;85(8):719-22.

23. Dzeletovic I, Ekbom DC, Baron TH. Flexible endoscopic and surgical management of Zenker's diverticulum. Expert Rev Gastroenterol Hepatol. 2012;6(4):449-65.

24. van Overbeek JJ. Pathogenesis and methods of treatment of Zenker's diverticulum. Ann Otol Rhinol Laryngol. 2003;112(7):583-93.