Staple-assisted endoscopic management of Zenker's diverticula: a role in the geriatric population

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Abstract Endoscopic stapling technique (modified Dohlman procedure) for treatment of hypopharyngeal diverticula (Zenker) has been shown to produce outcomes similar to open techniques but with shorter operating times and shorter hospitalization.

Keywords Zenker's diverticula · Endoscopic stapling technique

Introduction

In the geriatric population, dysphagia is a frequently described symptom with prevalence rates ranging from 6.9% up to 40% in selected populations [1]. Zenker's diverticulum (ZD) has been found to be almost exclusively affecting this older aged cohort.

ZD is a pulsion diverticulum of the hypopharyngeal mucosa between the inferior aspect of the inferior constrictor muscle and the cricopharyngeus muscle, an area known as Killian's triangle. While the first anatomic description was presented by Ludlow in 1769, it was only in 1878 that Zenker and von Ziemssen described the basic pathophysiology. It was suggested that diverticular formation began with reduced compliance of the cricopharyngeus muscle. This would subsequently result in both decreased muscular contractility and increased resistance to the passage of a bolus thereby priming the clinical entity of ZD. Immuno- and enzymohistochemical research studying cricopharyngeal muscle biopsies in patients with ZD have supported the proposed pathophysiology [2, 3]. Recent morphological and histological findings suggest that progressive denervation of the cricopharyngeal muscle may contribute to alterations of the morphological characteristics of the muscle thereby accounting for the development of ZD [2].

Once a diverticulum is formed, the first symptom experienced by patients is intermittent oropharyngeal dysphagia. In more severe cases with larger diverticula, patients may develop classic symptoms of cough, fullness and gurgling in the neck (cervical borborygmi), postprandial regurgitation of undigested food, chronic aspiration, halitosis, weight loss, and less commonly, hoarseness.

Since symptomology is often related to the size of diverticular formation, true incidence rates and general epidemiological characterization have been difficult to establish. However, a community study from the United Kingdom estimates an annual incidence of 2 per 100,000/year [1]. Typically found in persons over the age of 50, ZD affects males more than females in a ratio of 1.5:1. Due to its predisposi-

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tion for males in their 7th decade or greater, management of this disease is often found within the challenging milieu of co-morbid medical conditions such as major cardiac and pulmonary compromise.

The gold standard of treatment for ZD is surgical and the first attempted excision occurred in 1885 by Wheeler. This pioneering movement initiated a variety of external surgical approaches involving a diverticulectomy or diverticulopexy accompanied with a cricopharyngeal myotomy. Traditionally considered the standard of surgical care, open diverticulectomy combined with cricopharyngeal myotomy is associated with postoperative enteral nutrition via a nasogastric tube, and can be involved with significant dissection for access and lengthier hospital stays.

To minimize the amount of soft tissue dissections, lengthy operative times, and to better facilitate treatment in an already vulnerable patient population, it was thought to explore minimally-invasive surgical options. Therefore in the attempt to improve care, Mosher first described an endoscopic approach in 1917 where he sharply divided the common muscular septum between the cervical esophagus and the diverticular pouch thereby creating a single lumen. Though this procedure resulted in symptomatic improvement, it was abandoned because of the high frequency of mediastinitis. In 1960, Dohlman and Mattson reintroduced the technique using electrocautery. This approach resulted in an attenuated complication rate which helped popularize the technique. Since then, endoscopic variations of creating a single lumen have evolved to include via stapling, electrocoagulator or lasers.

However, due to enduring concerns of pneumothorax, bleeding and mediastinitis, acceptance of the endoscopic approach has been gained slowly in North America. In 1993, Martin-Hirsch in England and Collard in Belgium, simultaneously described dividing the common wall with an endosurgical stapler [4, 5]. Scher and Richtsmeier refined this technique and in 1996 introduced it to the American armamentarium of treatment modalities for Zenker's [6]. In Canada, there have been limited documented reports describing the surgical management of ZD and no reports have been found describing our experience with modern endoscopic techniques [7].

The advantages of using a stapling device over an electrocoagulator or laser are better hemostasis and avoidance of thermal damage to the recurrent laryngeal nerve [8]. Also beneficial is a reduced risk of perforation and subsequent mediastinitis since the divided edges of the septum are sealed by the staples [7]. When compared to traditional open procedures, the endoscopic staple-assisted approach offers numerous advantages by potentially allowing for a shorter operative time and associated anesthetic duration, shorter hospital stays, and reduced time to resume oral feedings and overall convalescence [9–11]. Some studies also quote minimal postoperative pain and increased patient satisfaction [12]. These considerations are all significant

when considering that Zenker's is observed almost exclusively in the geriatric population, and often in those patients with significant co-morbidities.

Objectives

The objectives of this study were to describe the Canadian experience with managing ZD via endoscopic techniques and to examine our endoscopic experience in a tertiary-care Canadian Otolaryngology department. In particular, attempts were made to compare success and complication rates of our staple-assisted endoscopic approach to literature reports of the open surgical management. These evaluations will then aid in elucidating a role for the endoscopic management of ZD in an appropriately selected patient population.

Patients and methods

Patient population

A retrospective chart review of all patients who underwent endoscopic, staple-assisted Zenker diverticulotomy at St. Michaels Hospital, Toronto, Ontario, between January 1, 1996 and December 31, 2002, was performed (Fig. 1). Data was collected on the demographics, patient presentation (symptomology, clinical findings and barium swallow), operative details, and outcome on 28 consecutive patients who underwent endoscopic repairs by the senior author (RSF) at St. Michaels Hospital. Demographic information included age at surgery, gender and presence of co-morbid illnesses. These co-morbidities were categorized as being either Major or Other with specific attention paid to major cardiac or pulmonary co-morbidities. However, patients were excluded if they had evidence of prominent maxillary teeth, cervical spondylosis or poor neck extension. Patient presentation included type and length of symptoms, findings on clinical exam such as hypopharyngeal pooling on endoscopy, and size on barium esophagram. While no absolute size characteristics were pre-determined, patients were excluded if the pouch would not accommodate the size of the stapler. Perioperative details included surgical time, return to swallow, and number of days in hospital. Postoperative data included symptom resolution and need for re-operation. From our clinical perspective, acceptable functional outcome is defined as either complete resolution or minimal symptomology requiring no further surgery.

Procedure

Under general anesthesia and endotracheal intubation, a Weerda bivalved diverticuloscope was inserted with blades

into both the hypopharynx and into the pharyngeal pouch. After food debris and secretions were suctioned from the diverticulum to maximize visualization, a 35-mm Auto Suture Multifire Endo GIA 30 disposable stapler was placed through the diverticuloscope and into position with the longer staple cartridge blade in the esophagus. The endostapler was engaged and fired under magnified endoscopic visualization on the monitor. After removal of the stapler, the stapled party-wall was inspected for any defects. The stapler was reapplied for larger defects or incomplete division of the septum.

Results

Demographics

From 1996 to 2002, 28 primary and 4 revision cases led to a total of 32 consecutive endoscopic, staple-assisted diverticulotomy surgeries (demographics provided in Table 1).

Dysphagia was the most common clinical presentation as it was found in all patients and this was present for a mean duration of 30.6 months. Other rates of symptoms are found in Table 2. On physical exam, pooling was found on 53.6% of patients.

Perioperative

For 32 staple-assisted endoscopic surgeries, the mean surgical time was 34.1 ± 13.2 minutes. The time taken to return to swallow was defined as the time from the procedure until the patient was able to tolerate oral diets to meet full caloric needs. The mean number of days for patients to return to swallowing was 0.7 days (range 0–5 days). The length of hospital stay was documented as the time between the

surgery to time of discharge. In our experience, the mean in-hospital stay was 1.4 days (range 1–7 days).

In this cohort, 9.4% of cases experienced major complications which included perforation (2/32) and recurrent aspiration (1/32). Perforations were identified intraoperatively and were managed conservatively with endoscopic-guided nasogastric tube placement and observation for any signs or symptoms of mediastinitis (tachycardia, tachypnea, or chest pain). These patients passed a gastrograffin leak study at 48 hours postoperation and were then discharged home without any clinical sequela. One patient experienced recurrent aspiration events likely secondary to decreased laryngeal and pharyngeal tone from pre-surgical intracerebral events.

Conversely, 31.3% experienced minor complications that included dental chipping (5/32) and mucosal laceration (5/32). Both dental chipping and mucosal lacerations within their upper aerodigestive tract are attributed to placement of the endoscope.

Outcomes

Patients were scheduled for follow-up appointments at 1 week, 1 month and 6 month postoperation. After this appointment, patients made follow-up visits as needed. Of 28 patients, follow-up was successful in 23 patients for a mean time of 7.2 months. Five patients were lost to follow up. With regards to clinical outcome, 10/23 patients experienced a complete cure from their ZD symptomology and therefore requiring no further treatment. Six patients experienced minor dysphagia with 4 of those being managed conservatively and 2 requiring revision endoscopic surgery. Seven patients showed no improvement with 3 patients subsequently receiving conservative management and 4 requiring revision surgery. Of the 4 patients requiring revision surgery, 2 of these patients underwent open procedures. When considering patients cured and those managed conservatively, 74% of patients had achieved an acceptable functional outcome. However overall, 6 patients in total required some revision surgery, either endoscopic or open.

Discussion

The evolution of the surgical techniques to treat ZD has been substantial. Nearly a hundred years since Wheeler's first attempted excision in 1885, Gullane et al. had identified the CP myotomy to be the most essential aspect in the surgical management of ZD [6]. In the last decade, endoscopic management of ZD has become increasingly popular when contrasted to traditional open techniques because of evidence illustrating both its comparable safety and long-term efficacy [13].

Since ZD is found in the setting of elderly patients with co-morbidities, ideal surgery for this vulnerable patient

Table 1 Demographic details of study group

Gender	17 Male (60.7%) 11 Female (39.3%)
Age (mean, range)	72.5, range: 36–90
Co-morbidities	Major: 32.1% Minor: 71.4%

Table 2 Clinical presentation of study group

Symptom	Frequency (%)
Dysphagia	100
Regurgitation	89.3
Aspiration/Choking	50
Weight loss	21.4
Chest infection	17.9
Globus	10.7
Hoarseness	7.1

Fig. 1 Details of patients who underwent endoscopic, staple-assisted Zenker diverticulotomy

population should be one that achieves CP myotomy but reduces operative time, decreases anesthetic risk, and overall ensures a quicker convalescence. It is accepted that minimally invasive surgical management addresses these issues and can provide a suitable first line treatment strategy in an appropriately selected patient population.

Demographics and perioperative period

Our mean age of 72.5 years and an increased prevalence in the male population is generally consistent with the epidemiological data found on ZD [1, 14]. The mean surgical time of 34 min is consistent with literature reports of other endoscopic diverticulotomies [7, 9, 15, 16]. Elderly and frail patient are at an increased risk from general anesthetic and thus this select patient population can benefit from this relatively short surgical procedure. Operative times for open procedures often have a mean duration of nearly twice our quoted mean surgical time. Smith et al. demonstrated an average open procedure time of 87.6 minutes [9].

Convalescence

On average, it took about 0.7 days (range 0–5) for patients to return to swallow post-endoscopic surgery. Our mean hospital stay of 1.4 days is consistent with the endoscopic literature. Overall, our patients had an accelerated recovery especially when considering that only 3 patients experienced a convalescence longer than 1 day postoperatively. Reasons for delayed convalescence all involve major complications. These included two cases of perforations and one complicated course of aspiration pneumonia in a patient that had pre-morbid lung disease.

In comparison, hospital stays for open procedures are typically much longer with mean stays averaging 5.2 days [9]. Gross et al. have gone so far as to suggest that patients

undergoing endoscopic staple-assisted ZD can be managed safely even on an outpatient basis [10]. This abbreviated in-hospital convalescence can be translated by Smith et al.'s New York charge analysis demonstrating that cost savings can be appreciated with patients undergoing endoscopic management [9].

Complications

Our reports of perioperative complications are comparable to those found with open management strategies for ZD. In our cohort of 28 consecutive patients, Major complications occurred in 9.3% patients and 'Other' complications occurred at a rate of 30.3%. Comparatively, complication rates for open surgical management range from 10–38% depending on the surgical technique and size of the diverticulum [14, 17].

Our rates of intraoperative complications are also consistent with other endoscopic literature reports. In particular, mucosal laceration and tooth fracture are the most frequently cited minor complications and we believe that this can be resolved by careful insertion of the endoscope. Both major and minor complication rates can be minimized with increased experience, and are generally considered acceptable when contrasted to the perceived benefits of a primary staple-assisted endoscopic approach.

Outcomes

In our series, 74% of patients achieved an acceptable functional outcome as a direct result of our endoscopic staple-assisted diverticulotomy. Scher's Duke group has repeatedly supported the efficacy of endoscopic staple diverticulostomy and these findings are consistent with Sen et al.'s review of the literature where complete resolution of symptoms ranged from 53–100 percent of endoscopic

stapled reports [15, 18, 19]. In terms of open procedures for ZD, literature reports find that relief of symptoms was typically found in greater than 80% of patients [20]. Thus our results indicate that our surgical treatment efficacy is comparable to both other endoscopic reports and results of open ZD surgery.

There have been numerous reports that provide evidence that endoscopic diverticulotomy is effective and importantly, confers better patient satisfaction [11, 21]. In a patient questionnaire, Van Eeden et al. found more patients reported normal swallowing and were more pleased with endoscopic stapling than with other excision techniques [22].

Conclusions

Endoscopic procedures are the primary procedure for pharyngeal pouch surgery in our hospital. The advantages of an earlier commencement of diet and earlier hospital discharge have been realized and are of particular benefit to the elderly patient with co-morbidities. Though functional outcome rates are comparable to open procedures, the advantages of short operative and anesthetic time, quick return to oral alimentation, short hospitalization and documented patient satisfaction make this a favorable alternative in the geriatric population.

While not considered definitive treatment, we feel the advantages conferred by reducing morbidity associated with the surgery outweigh the risks of unacceptable functional outcome or need for treatment for recurrent and significant symptomatology. If recurrence does occur, revision surgery would also be considered. However, from our experience, a primary endoscopic approach can minimize the number of patients having to undergo more extensive open procedures. Thus our experience suggests that with adequate case by case evaluation, endoscopic staple-assisted diverticulotomy can be a safe and efficacious first line treatment option for the elderly and co-morbid patient suffering from the debilitating symptoms related to ZD.

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