Surgical treatment of cervical oesophageal diverticula

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ABSTRACT:
Aim: The aim of our study was to examine the results of surgical treatment of patients with cervical diverticula of the oesophagus over a period of 20 years.

Materials and methods: The study was a retrospective analysis of 65 patients with cervical diverticula of the oesophagus treated between 2000 and 2020. Patients with symptoms such as dysphagia, vomiting, choking, recurrent respiratory tract inflammation, as well as patients with diverticular recurrence or poor outcome of primary surgery, were qualified for surgical resection of the oesophageal diverticulum with myotomy using an open technique. Patients were evaluated for degree of dysphagia before and after surgery, associated perioperative complications, and overall comfort after surgical treatment.

Results: Sixty-five patients underwent surgical treatment, 7 (10.7%) of whom were treated for diverticular recurrence or poor outcome of primary treatment. The predominant symptom was dysphagia, which was found in 55 (84.6%) patients, increasing over a period of 6 to 48 months with a mean of 17.6 months. The size of the diverticulum ranged from 2 to 6 cm with a mean of 4.8 cm. One patient (1.5%) who experienced suture line leak was treated conservatively, and the fistula healed. Another patient had permanent vocal cord damage while 1 (1.5%) patient had transient damage. The surgical outcome was very good in 38 (69.1%) patients, good in 15 (27.2%) patients, and poor in 2 (3.6%) patients. No postoperative death occurred.

Conclusion: Transcervical method of treating diverticula is a safe way of dealing with an acceptable complication rate. It can be an alternative to endoscopic methods. It should be the method of choice in patients treated for recurrent diverticula after endoscopic treatment.

KEYWORDS: oesophagus, resection, Zenker diverticulum

ABBREVIATIONS

CT – computed tomography
Z-POEM – Per Oral Endoscopic Myotomy

INTRODUCTION

The cervical diverticula of the oesophagus are located at the dorsal wall of the junction between the hypopharynx and oesophagus. They present between the oblique muscle fibres of the inferior constrictor muscle and the transverse fibres of the cricopharyngeal muscle in the area of weakness called Killian’s triangle. Cricopharyngeal muscle and inferior constrictor muscle are both components of the upper oesophageal sphincter [1–3]. There are two types of diverticula, the Zenker and the Killian-Jamieson diverticulum. Symptoms most commonly include progressing dysphagia, regurgitations, fevor ex ore, gurgling noises in the neck, and aspirations. Cervical diverticula usually affect elderly patients between the age of 70 and 80 years [1–3]. Treatment options include open diverticulectomy with myotomy or endoscopic submucosal incision of the septum called Z-POEM (Per Oral Endoscopic Myotomy).

MATERIAL AND METHODS

Patients operated in the Department of Thoracic Surgery, John Paul II Hospital, Jagiellonian University Collegium Medicum for diverticulum of the cervical part of the oesophagus between 2000 and 2020 were retrospectively analysed. All patients were operated in a traditional transcervical approach.

Patients

The study involved 65 patients. In the analysis, all patients were divided into two groups: 50–72 and 73–88 years of age. Taking into account differences in surgical treatment, we analysed patients with and without postoperative drainage.

The patients were treated with perioperative antibiotic prophylaxis. Antibiotic therapy was started in the case of complications such as leakage after resection or re-operative treatment. Perioperative complications were analysed using the Clavien-Dindo classification [4]. The Visick score was used to evaluate postoperative comfort [5].

Diagnostics

The diagnostic work-up included chest radiography, barium (contrast) swallow, oesophagoscopy, and in select cases, bronchoscopy and computed tomography of the cervical part and chest. The diverticula were divided according to the Morton-Bartley scale [6].

Dysphagia was assessed according to a four-grade scale [7]:

- 0 – no dysphagia,
- 1 – swallowing of a semi-liquid diet,
- 2 – swallowing of a liquid diet,
- 3 – dysphagia to the liquids and saliva.
SURGICAL TREATMENT

Indications

Indications for surgical treatment were: dysphagia with confirmed Zenker’s diverticulum, suspected aspiration pneumonia, vomiting, and diverticulum recurrence after surgical treatment or failed treatment attempt.

Surgical Technique

The skin is incised along the sternocleidomastoid muscle on the left side. After dissection of the platysma, the omohyoid muscle is visualised and transected if needed to reach the pharyngo-oesophageal area. The carotid sheath is carefully retracted laterally and the thyroid lobe medially to expose the diverticulum. The left recurrent laryngeal nerve is identified. If indicated, hemi-strumectomy is performed. The neck of the diverticulum is either dissected with the stapler device (TA-30 Ethicon, USA; Endo-GIA 45 Auto-Suture, USA) or cut and hand sewn with PDS 000 (Tab. III.). A 1-cm margin is left in order to prevent postoperative oesophageal strictures. The myotomy was started at the cricopharyngeal muscle transection and extended for 3–5 cm long distally of the proximal oesophageal muscle layer. Oesophagoscopy is routinely used to check for anastomotic leak. Drain and nasogastric feeding tube placement depends on the operating surgeon’s preferences.

Postoperative period

On the postoperative day, one patient with nasogastric feeding tube was given enteral nutrition and patients without the tube were allowed clear fluids progressing to a liquid diet. Intravenous fluids were prescribed and in case of a lack of tolerance for enteral feeding, total parenteral nutrition was initiated.

The nasogastric tube was routinely inserted in patients until 2008, and up until then, the integrity of the oesophageal suture line was evaluated from the 7th to 10th postoperative day using contrast examination. After 2008, patients were given clear fluids on the 1st postoperative day and the oesophageal suture line integrity was confirmed on postoperative day 4 or 5 by either using contrast examination or oesophagoscopy. Bronchoscopy was performed in patients with symptoms of vocal cord paralyses.

All patients are advised a fragmented diet for 2 weeks following discharge.

Follow-up

Dysphagia was assessed on the first day after the procedure. Patients were evaluated on the first day after surgery and every 3 months thereafter. If the follow-up on site was not feasible, patients were interviewed by phone. During the follow-up visit, the patients’ general condition, dysphagia, vocal cord function, and comfort were assessed [5].

STATISTICAL ANALYSIS

All statistical analyses were performed with the Statistica 10PL software package (StatSoft, USA). For demographic and clinical data, descriptive statistics were used (mean value, median, and range). The non-parametric Wilcoxon-Gehan test was used to assess the degree of dysphagia before and after surgery. Qualitative variables were expressed as a number, and percentages were compared using the chi-square test and Fisher’s test. These included: clinical size of the diverticula in age groups, differences between groups with and without drainage, and comfort after surgery. P < 0.05 was considered statistically significant.

RESULTS

The retrospective analysis included 65 patients of which 45 were male and 20 female ranging in between 50–88 years of age with a mean age of 78 years. Among the treated patients, 47 (72%) were
in the age range of 72–88 with a mean age of 75.8 and 18 (28%) were in the age range of 50–72 with a mean age of 67.8, with a statistical difference (P = 0.002) between the age groups (Tab. I).

Sixty-four patients were operated on for a Zenker diverticulum and one for Kilian-Jamieson’s diverticulum. The patients were followed for 4 to 48 months (median 22 months). Among the operated patients, the diverticulum size ranged between 2 and 6 cm with a mean of 4.8 cm (Tab. II). The predominant symptom among patients was dysphagia, which increased over a period of 6 to 48 months (median 17.6 months). In the preoperative evaluation, the degree of dysphagia in patients ranged from 2 to 3 with a mean of 2.21, and after surgical treatment it was 1–2 with a mean of 1.3 (P = 0.0021).

Until 2008, in the group of patients operated on, the average hospital stay was 11.2 days (range 9–17 days), and after 2008, the average stay was 5.8 days (from 4–7 days), which is a statistically significant difference (P = 0.003). There was no statistical difference in the occurrence of perioperative complications between the two groups (P = 0.65). Also, we have not found any difference in the complication rate depending on the method of diverticulum resection, resection with hand sewing or the use of a stapler (P = 0.48) (Tab. III.). The surgical outcome was very good in 38 (69.1%), good in 15 (27.2%), and poor in 2 (3.6%) patients (Tab. III.). There was no postoperative death. Patients were followed for 4 to 32 months, median 21 months.

**Perioperative complications (Tab. IV.).**

**Major perioperative complications**

One patient (1.5%) had very good results, two patients (3%) had good results and one patient (1.5%) had a poor result.

Two patients (3%) developed transient vocal cord paralysis (Grade 1), which resolved 3 and 4 months after surgical treatment, as confirmed by bronchoscopy [4].

One patient (1.5%) had postoperative bleeding that required 2 reoperations, and another patient (1.5%) had a reoperation due to haematoma (1.5%) (Grade 1) [4].
Three patients who received endoscopic treatment experienced difficulty swallowing while being fed a liquid diet. Failure of endoscopic treatment was the reason for transcervical resection. After surgical treatment, the patients were fed a complete diet, and there were no complications in the perioperative period. The outcome of the surgical treatment was very good.

The fourth patient was operated on at another centre where the diverticulum was incorrectly identified. The healthy oesophageal wall was resected with a mechanical suture, and the left recurrent laryngeal nerve was injured. After repeated diagnostics, the diverticulum was confirmed, and the patient was scheduled for reoperation. The diverticulum was resected, but laryngeal nerve function did not return. Despite resection of the diverticulum and feeding the patient a complete diet, the outcome was considered poor due to persistent vocal fold paralysis.

In the fifth patient treated at another centre, diverticular resection was abandoned due to difficult intraoperative conditions, and he was reassigned to surgery. There were no complications during the surgery and in the postoperative period. The outcome of the surgical treatment was very good.

Two patients were qualified for reoperation due to diverticular recurrence. Diverticular recurrence occurred at 20 and 28 months. The patients were operated and reoperated on in our clinic. There were no complications after the surgical treatment and the outcome was good.

DISCUSSION

The location of the diverticula is typically in Kilian’s dehiscence, between the lower pharynx and oesophagus, on its posterior or posterolateral wall.
Based on the location and pathophysiology, the most common is the Zenker’s diverticulum and the rarest is the Killian-Jamieson’s diverticulum (39 patients with the latter diverticulum have been described so far) [8]. These diverticula are often misdiagnosed and therefore lead to therapeutic errors. Zenker’s diverticulum is associated with cricopharyngeal muscle dysfunction and pharyngeal dysfunction, and is usually located on the posterior wall of the pharynx. This type is characterised by swallowing disorders and choking of patients. Killian-Jamieson diverticula also result from cricopharyngeal muscle dysfunction and involve oesophageal dysfunction occurring on the anterolateral wall below the cricopharyngeal muscle, which is “closed” and does not cause choking and aspiration in patients [8–11].

Therapeutic management of Killian-Jamieson’s diverticula is not clear. Conservative management is recommended if patients show few clinical symptoms. In surgical management, performing an oesophagomyotomy is controversial. One patient in our analysis underwent diverticular suspension with proximal oesophagomyotomy without transection of the cricopharyngeal muscle. There were no complications in the postoperative period and the long-term outcome of swallowing comfort was good. In the surgical management of this type of diverticulum, attention should be paid to the location of the recurrent laryngeal nerve, which runs at the base of the diverticulum; therefore, some practitioners qualify patients for open rather than endoscopic surgery [8].

Progressive dysphagia, aspiration pneumonia, lung abscess, and cachexia are risks that are particularly dangerous for patients in this patient group. The risk of their occurrence should determine the early qualification of patients for surgical treatment. Although the surgical risk, especially for elderly patients, is much higher, surgical diverticulectomy with oesophagomyotomy is a safe procedure with a low rate of perioperative complications, which is also confirmed by our results [12–16].

The selection of a surgical technique for the treatment of cervical oesophageal diverticula is still under discussion. There are open techniques and endoscopic ones. Endoscopic techniques are considered the gold standard of management due to their increasingly lower complication rates and increased efficacy in comparison to open techniques [17]. In both of these treatment techniques, one can distinguish different approaches as well as different results. In the open technique, Gutschow et al. suggest that management should depend on the size of the diverticulum. For diverticula <1 cm in size, he recommends myotomy only, whilst diverticular suspension and myotomy are recommended for diverticula between 1 and 4 cm and resection and myotomy are indicated for diverticula of over 4 cm [18]. Other treatments include invagination (imbrication), which is not recommended because of its high recurrence rate [19]. Our report presents patients treated with resection. Resection was performed using a stapler, and excision with hand stitching of the oesophagus bed. Both methods are highly effective and have a low complication rate.

Endoscopic techniques also vary, as one can perform the procedure with the Z-POEM technique, but there are also techniques using an endostapler, ultrasound knife, or laser, where the septum between the diverticulum and the oesophagus is cut and a myotomy is performed. In a meta-analysis of patients treated with the open and endoscopic technique, Verdonc et al. found that failures were more frequent after the endoscopic than open technique (4.2% vs. 18.4%, respectively) while complications were more frequent after the open than endoscopic technique (11.0% vs. 7.0%, respectively) [2]. Visosky et al. indicate that of the 15% of patients treated with endoscopic techniques, 63.7% required open surgical treatment [20]. Cheng et al. also report similar rates of recurrence and reoperation in patients who underwent open technique surgery [21]. A key consideration for endoscopic approaches is the size of the diverticulum and thus the length of the diverticular septal incision. In fact, incomplete septal transection is a cause of relapse. Many authors consider that a septal length of 6 cm is the limit for this procedure and has a high risk of perioperative complications for the patient [13, 22, 23]. A sutureless incision of the long oesophageal segment is at risk of bleeding, whereas the use of the stapler technique can lead to an oesophageal fistula [2, 12, 24]. This technique cannot be used in small diverticula, where insertion of a stapler may not be possible. Bonawina et al. and Gutschow et al. note that the results of treating diverticula smaller than 3 cm remain more favourable when using the open technique [13, 18, 19]. In our report, 3 patients were reoperated after endoscopic septotomy with a septum length of 4–6 cm. After transcervical treatment, a satisfactory result was achieved and swallowing comfort was restored.

Myotomy remains the standard of care for the surgical treatment of oesophageal diverticula. It was proposed in the 1960s by Belsey [25]. He pointed out that a myotomy is necessary to treat Zenker’s diverticulum due to upper sphincter dysfunction, and that a failure to perform it entails disease recurrence and a fistula in the diverticulum resection line. This belief is currently widely accepted. Cricopharyngeal muscle transection is not only used to treat diverticula, but it is also effective in patients with a history of neurogenic or myogenic swallowing disorders [26]. Despite the consensus on performing myotomy in the surgical treatment of cervical diverticula, there is none regarding the extent to which it should be performed. It has been suggested that a 2–6-cm section be used. Lerut et al. propose performing it on a segment up to 4–5 cm in length, and Colombo-Benkmann et al. believe that it should be performed selectively [15, 27]. The authors state that the use of this technique depends on the evaluation of the cricopharyngeal muscle; they only recommend it in patients who show hypertrophy of this muscle [27].

Performing a myotomy is one of the management components that should restore normal swallowing. The correct act of swallowing is also conditioned by other factors, such as normal elevation function of the pharyngeal and laryngeal segments in which normal pharyngeal function is emphasised. Overbeek et al. point out that posterior pharyngeal wall flaccidity may indicate a poor surgical outcome and recurrence of diverticulum [1]. The observations of Overbeek et al. were not confirmed by Visser et al., as they found that the patients who developed pharyngeal flaccidity did not require surgical intervention at long-term follow-up [28].

Recurrence of the diverticulum is one of the late postoperative complications, though it is rare, ranging from 0% to 5% [12, 13, 15, 19]. The cause of recurrence is not exactly known, but it can include incomplete myotomy, which may be diagnosed by dynamic contrast radiography showing an impression in the projection of the cricopharyngeal muscle and the aforementioned pharyngeal flaccidity. In the present study, 4 patients underwent repeated diverticular resection: 2 due to recurrence and 2 after an unsuccessful resection attempt. Reoperation is challenging, and the patients are a high-risk group.
associated with laryngeal nerve injury and/or the development of a salivary fistula. All patients had a satisfactory outcome after the treatment. Other authors also show good postoperative results but warn of intraoperative and perioperative risks [13, 18, 19].

Surgical management has a relatively low rate of perioperative complications, and outcomes depend on the experience of the centre. The mortality rate ranges from 0.2% to 3%, with a mean of 0.6%, though other complications occur at a rate of about 10%, ranging from 0% to 46% [13, 18, 19, 22]. Surgical management is also associated with life-threatening complications, including leakage in the line of the resected diverticulum, which is estimated to occur in about 3.3% of cases, although some report figures of more than 5% [18, 19, 22]. Leakage after a resected diverticulum is a risk for descending mediastinitis, estimated to occur at a rate of 0.2%, and requires extended diagnostics (CT scan). Its management mostly involves conservative treatment as surgical intervention is rarely undertaken [22]. Laryngeal nerve palsy, which can be temporary in 2.6% of cases and permanent in between 1.6% and 3.3% of cases, is another severe complication [13, 15, 18, 19, 22].

Surgical treatment shows a high satisfaction rate among treated patients ranging between 85 and 100% [12, 18, 19, 29]. In this analysis, satisfaction was rated at 96%.

**CONCLUSION**

Transcervical treatment of cervical diverticula is associated with a low complication rate and a very good patient satisfaction score. This method of treatment should be the method of choice for recurrence of diverticula after endoscopic treatment. It is also a safe alternative for elderly patients if treatment using the endoscopic technique cannot be performed.
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