ORIGINAL ARTICLE

Treatment of Zenker’s Diverticulum: Comparison of Different Techniques

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Received 17 April 2012; accepted 6 June 2012

KEYWORDS
Zenker’s diverticulum; Endoscopic treatment; CO₂ laser; Surgical stapler; Open surgery

Abstract
Introduction and objectives: Zenker’s diverticulum has been approached surgically with different techniques over the years, evolving from open to endoscopic surgery. The CO₂ laser or the stapler can be used in endoscopic surgery. Our objective was to ascertain the recurrence or persistence of the diverticulum based on the type of surgery performed.

Method: A retrospective descriptive study of 22 patients treated for Zenker’s diverticulum in our hospital service between 2001 and 2011.

Results: Endoscopic surgery using laser CO₂ was performed in 13 patients, using stapler in 6 patients and with open approach in 3 patients. Surgery time, oral intake and hospital stay were greater in the open approach (107 min, 8 days and 11 days, respectively) and less in surgery with stapler (52 min, 3 days and 5 days) than the technique with laser (58 min, 5 days and 8 days). With the first intervention, 68% of our patients improved, a percentage that increased to 95% taking into account the second intervention in patients that relapsed after the first surgery. Complications appeared in 13.6% of the patients.

Conclusions: The treatment of choice nowadays for Zenker’s diverticulum is endoscopic surgery. The endoscopic approach with stapler seems to present lower morbidity and a shorter hospital stay in comparison with the CO₂ laser.

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PALABRAS CLAVE
Divertículo de Zenker; Tratamiento endoscópico; Láser CO₂;

Tratamiento del Divertículo de Zenker: comparación de Diferentes Técnicas

Resumen
Introducción y objetivos: Los divertículos de Zenker se han abordado quirúrgicamente con diferentes técnicas a lo largo de los últimos años, evolucionando desde la vía abierta hasta la endoscópica. En la cirugía endoscópica, se puede utilizar el láser CO₂ o la grapadora. Se analizó la recidiva o persistencia del divertículo tras el tipo de cirugía realizado.

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Introduction

Zenker’s diverticulum is an acquired hernia from the posterior pharyngeal mucosa developed in the pharyngoesophageal junction, among the fibres of the inferior constrictor and cricopharyngeal muscles (Killian triangle). They are called false diverticula because their walls lack muscle, being composed of only mucosa and submucosa. Their formation is favoured by a distal obstacle, secondary to a cricopharyngeal muscle dysfunction (delayed or impaired relaxation).

They are rare, with prevalence between 0.01 and 0.11%.\(^1\) They present in two different age groups: adults from 55 to 65 years old (predominantly in males) and the elderly over 80 years old (especially in females).

Deglutition alterations represent basically regurgitation of undigested food up to several hours after having swallowed it. In addition, they can provoke coughing fits and dysphagia. The seriousness of this entity is seen in the weight loss and aspiration pneumonias, representing a threat to patient life, particularly in the elderly with poor general health. The risk of malignant transformation is low; it has been described in less than 4% of the cases.\(^2\)

The gold standard for diagnosis is pharyngoesophageal barium swallow study (Fig. 1).

Treatment for the diverticulum is surgical. It is indicated when there is oropharyngeal dysphagia or regurgitation, and to prevent complications from aspiration pneumonia.

Traditional surgical treatment consists of removal of the diverticulum associated with the myotomy of the upper oesophageal sphincter by open approach. Cricopharyngeal myotomy creates a weak area in the muscle, which can cause the pharyngeal pressure to be distributed during deglutition.

Endoscopic treatment is also an efficient option to resolve the problem. The intervention consists of an oesophageal diverticulostomy with transmucosal myotomy of the upper oesophageal sphincter (Fig. 2). The wall between the diverticulum and the oesophagus can be sectioned using CO\(_2\) laser or stapler (Endogia\(^®\)).

Material and Method

This was a retrospective descriptive study on all the patients with Zenker’s diverticulum treated surgically in the

**Método:** Es un estudio descriptivo retrospectivo de 22 pacientes tratados de divertículo de Zenker en el servicio de otorrinolaringología de nuestro hospital entre los años 2001 y 2011. **Resultados:** Se realizó tratamiento con cirugía endoscópica mediante láser CO\(_2\); en 13 pacientes, mediante grapadora en 6 pacientes, y en 3 pacientes se realizó abordaje abierto. El tiempo operatorio, de ingesta oral y de ingreso fueron menores en la cirugía con grapadora (52 min, 3 días, 5 días), que en la técnica con láser (58 min, 5 días, 8 días) y mayores en el abordaje abierto (107 min, 8 días, 11 días). El 68% de nuestros pacientes mejoró con la primera intervención, porcentaje que ascendió al 95%, teniendo en cuenta la segunda intervención en los pacientes que recidivaron tras la primera cirugía. Las complicaciones aparecieron en el 13.6% de los pacientes. **Conclusiones:** El tratamiento de elección en la actualidad del divertículo de Zenker es la cirugía por vía endoscópica. El abordaje endoscópico con grapadora parece presentar menos morbilidad y un tiempo de hospitalización más corto en comparación con el láser CO\(_2\). © 2012 Elsevier España, S.L. Todos los derechos reservados.

**Figure 1** Zenker’s diverticulum in pharyngoesophageal transit barium swallow.

**Figure 2** Common wall between diverticulum and oesophagus by endoscopic approach. A nasogastric tube has been introduced into the oesophagus.
Otorhinolaryngology Service at our hospital between November 2001 and November 2011, from the database in our service.

The following parameters were analysed: age and sex, preoperative symptoms, diverticulum size, surgical type and duration, period until oral intake after surgery, length of hospital stay, complications, postoperative results and follow-up period.

For diagnosis of this disease, barium swallow and fibroptic laryngoscopy were used in all cases.

Three types of surgery were performed: open surgery, endoscopy with CO₂ laser, and endoscopy with stapler.

The external approach included exposition and elimination of the diverticulum, using cervicotomy and myotomy of the cricopharyngeal muscle.

The endoscopic approach consisted of the placement of a diverticuloscope between the oesophagus and the diverticulum to expose the common wall. In some patients, the wall was sectioned with CO₂ laser, while a 12-mm Endogía Autosuture™ stapler was used in other patients.

To assess the clinical result following surgery, the patients were classified into three groups: complete improvement, partial improvement, and relapse or persistence. Complete improvement was defined to be normal swallowing, with the patient being able to eat all types of food without any alterations. Partial improvement was considered as improvement in part of the patient symptoms, with this improvement being sufficient to preclude a new operation. We defined relapse or persistence as the situation when the symptoms described throughout the follow-up were the same as those present before the surgery; even if these had improved in the first follow-ups, they reappeared as time went by. All patients that required a new surgical intervention were included in this group. Postoperative pharyngoesophageal transit of the patients in this group confirmed that the diverticular pouch was maintained.

We performed a pharyngoesophageal barium swallow study before and after the intervention in all patients to assess the diverticulum.

Mean follow-up was 21 months.

Results

Of the 22 patients operated on for Zenker’s diverticulum, 13 were male and 9 were female. Their ages were between 46 and 87 years, with a mean age of 65.5 years. Dividing them into the two groups of maximum incidence described, the first group (55–65 years old) consisted of 5 men and 3 women; there were 3 women and 0 men in the second group (more than 80 years old).

All the patients presented symptoms, with dysphagia being the most frequent (18 patients). In order, the next was regurgitation (14 patients), 5 reported coughing, 4 had weight loss, 3 suffered from choking, 2 from aspiration and (to a lesser degree) chest tightness, presence of a foreign body, pain, discomfort in deglutition and reflux.

The mean size of the longitudinal axis of the diverticulum was 37 mm (range: 20-69), as measured in the barium swallow.

Of the 22 patients that were operated on, the intervention was endoscopy using CO₂ laser in 13 (59%), endoscopic stapling in 6 (27%), and open approach through cervicotomy in 3 patients (14%).

Mean duration of surgery was 63 min (range: 30-130). This time period varied depending on the type of surgery: mean of 58 min for surgery with laser, 52 min for stapling and 107 min when the open approach was used.

Mean length of time until the patients returned to oral intake, independently of surgical technique, was 5 days (range: 2-27). The mean was 5 days following laser surgery, 3 days after stapling and 8 days following cervicotomy.

Mean hospital stay was 7 days (range: 3-33); hospital stay was a mean of 8 days in patients operated on with laser, 5 days in those operated on with stapling and 11 days with open surgery. If we do not consider the mean stay (33 days) and the time until renewed oral intake (27 days) of the patient that suffered the most serious complication (an oesophageal fistula), the mean stay for patients operated on with CO₂ laser was 5.5 days and the time until oral intake with the same technique was 3.5 days.

Postoperative complications appeared in three patients (13.6%): one of them presented bleeding and a small pharyngostoma, which closed spontaneously (open surgery patient); another presented pharyngoesophageal stenosis; and the third patient presented cervical mediastinal emphysema and oesophageal fistula with pleural effusion (these last two cases were operated on with laser). The third patient required suture of the oesophageal perforation and drainage of the effusion.

Following the surgery, 11 patients (50%) recovered completely, 4 (18%) improved partially and 7 (32%) did not improve, reporting the same clinical symptoms as before the intervention (Fig. 3).

The three individuals that received open surgery all recovered completely (100%). Among those operated on with laser, six recovered completely (46%), two improved partially (15%) and five did not improve or the condition recurred (38%). From the patients that underwent the stapling technique, two recovered completely (33%), two improved partially (33%) and the other two did not improve (33%).

The mean time of recurrence of symptoms was 11 months (1-96). Four patients were reoperated with laser surgery, two patients underwent endoscopic stapling and a cervicotomy was performed on one. Symptoms improved for all of the patients after the reintervention, except for one patient, on whom we had to operate a third time.

Of the total, 15 patients (68%) improved their symptoms with the first operation. The clinical picture improved in

![Figure 3 Results of treatment for Zenker’s diverticulum following surgery.](http://www.elsevier.es)
95.5% of the patients, taking into consideration also the second interventions for those who needed one.

Discussion

Treatment for Zenker’s diverticulum has evolved throughout history. It was Zenker that, in 19th century, presented its physiopathology. In 1885, Wheeler described the first surgical removal of one. Attempting to improve results and morbidity, Mosher was the first to describe, in 1917, endoscopic oesophageal diverticulostomy using a scalpel to divide the common wall. However, he abandoned the procedure after seven of his patients died from mediastinitis. Dohman and Mattson took up the endoscopic procedure again in 1960, using diathermy coagulation, in a series of 100 patients treated without loss of life or severe complications. Van Overbeek introduced the use of the CO2 laser in endoscopic approach in 1981. In 1993 Martin-Hirsch et al. and Colard et al. simultaneously introduced endoscopic stapling in England and Belgium, respectively.

Our patient sample was limited. This was due to, firstly, the low prevalence of the problem and, secondly, to the fact the Zenker’s diverticulum began to be treated surgically at our hospital’s Otorhinolaryngology service with greater frequency in 2001. Before that, it had been treated in general surgery. From 2001 on, the availability of the CO2 laser made it possible to operate on the patients endoscopically if the procedure was feasible and no contraindications existed. If the diverticulum could not be seen correctly with the endoscope, external approach cerviotomy was performed. The endoscopic surgical stapling technique was introduced in 2009 and is still in use today.

Endoscopic procedures are recent technological advances compared with external techniques. They offer good outcomes in patients with symptomatic Zenker’s diverticulum that can be given general anaesthesia. The objective of the treatment is double: eliminating the reservoir that contains the food and the myotomy of the cricopharyngeal muscle to attempt to eliminate the cause that led to the formation of the diverticulum.

The endoscopic approach seems to be better adapted to the elderly because of the short duration of general anaesthesia; it is a simple procedure, adapted to weakened patients; there are no postoperation scars or risk of recurrent paralysis. In our study, we found that surgery time, time until oral intake and days of hospital stay were greater in patients operated with cerviotomy than endoscopy (58 min vs 107 min, 5 days vs 8 days and 8 days vs 11 days, respectively). Another factor in favour of endoscopy is that it is economical. In a study by Shane et al., the economical cost of both surgical procedures (endoscopic approach, open approach) were found to be similar, but the hospital cost was significantly less in patients treated endoscopically.

Some studies assert that recurrence rates are somewhat higher with endoscopy than with the cervical approach (13% against 0.5%), probably because of an incomplete procedure. Recurrence rates have been described ranging from 6.6% in some series treated with stapling, up to 21% in others treated with CO2 laser. However, Bonavina carried out a retrospective study on 297 patients, 181 that underwent endoscopy using endoscopic stapling and 116 using external treatment. A recurrence rate of 5% was found in open approach, while that of endoscopic treatment was 6.6%. There is little difference in the success rate between the two procedures. However, in our series there was no recurrence with open surgery and seven recurrence cases (32%) with endoscopy. Incomplete endoscopic division of the cricopharyngeal muscle or restenosis from the common wall scar could explain this higher recurrence rate with this approach.

Comparing the two possibilities of endoscopic surgery, after assessing 72 patients operated using laser and 35 with stapling, Verhaegen observed that fever and emphysema in the neck or mediastinum occurred more frequently in the CO2 laser group, but without serious complications. The stapling technique can reduce the risk of perforation and of mediastinitis, given that it leads to better haemostasis and avoids thermal damage to the recurrent laryngeal nerve.

According to the revision by Chang, 88% of the 150 patients operated using stapling reported complete or partial recovery of the symptoms in their follow-up. In our series, eight patients (61%) operated using laser and four patients (66%) of those with stapling completely or partially improved their symptoms.

Aly et al. recommend avoiding endoscopic stapling for diverticula smaller than 2 cm or larger than 10 cm, because of the difficulty in its placement. It is also contraindicated when there is incorrect diverticula and oesophagus exposure due to problems of buccal opening or cervical flexion-extension. These contraindications not only exclude the use of stapling, they also exclude the endoscopic laser approach.

For three of our patients, the endoscopic technique was abandoned because of the incapacity of visualising the diverticulum and an external approach was used.

Our complication rate was 13.6% (three patients): one of them more serious (4.5%), in which there was oesophageal fistula and cervical mediastinal emphysema. Complications through endoscopic approach arose in 9% of the cases.

In a series of 507 patients operated with the endoscopic approach, Van Overbeck reported an 8% complication rate, which included less than 2% of mediastinitis, 12 transitory emphysemas and 1 fistula. The approximate mortality rate was 1.2%, identical with all the therapeutic procedures.

In another study, there was no mortality in the 159 cases treated with endoscopic stapling. The range of complications was 12.7%. Of these complications, 2% were significant, such as perforation, aspiration pneumonia and transitory vocal fold paralysis.

Despite being aware of our high recurrence rate, we prefer to be cautious in resecting the wall between the diverticulum and the oesophagus so as to avoid important complications, such as opening the oesophagus. Any clinical symptoms that might persist are corrected with a second intervention; very good results (95% improved their symptoms) are achieved with a low rate of significant complications.

Conclusions

The treatment of choice for Zenker’s diverticulum is currently surgery with the endoscopic approach, given that it
offers significant advantages over the open technique: it is a safe, effective procedure, without scarring, and has shorter surgery duration, hospital stay and time until renewed oral intake. Postoperative complications are rare and there is no risk of recurrent nerve lesion.

For cases in which the endoscopic technique cannot be performed, open surgery can be chosen as an alternative.

Specifically, endoscopic stapling seems to present lower morbidity and shorter hospital stays compared with CO2 laser, due to earlier resumed oral intake.

Conflict of Interests

The authors have no conflict of interests to declare.

References