INTRODUCTION

Zenker’s diverticulum is a protrusion of the hypopharyngeal mucosa through a week area between the inferior pharyngeal constrictor muscle and the cricopharyngeus muscle. The disease was first described in 1769 by Ludlow and further explored and characterized in 1877 by Zenker. The treatment of Zenker’s diverticulum has undergone evolution from open surgery with removal of the diverticulum and external myotomy of the cricopharyngeal muscle to an endoscopic procedure with division of the mucomuscular bridge (the septum), which consists of the structures between the diverticulum and the esophagus. The endoscopic procedure was performed for the first time in 1917 by Mosher using scissors. The procedure was soon abandoned after a patient died from mediastinitis. In the 1960s, the endoscopic approach was resumed by Dohlman, who used diathermy to cut the septum.

The difficulties in the procedure lie in the dilemma that to solve the patients problems enough of the septum has to be removed, but on the other hand, a too deep incision can lead to an esophageal perforation, with flow of saliva into the mediastinum and the risk of potential life-threatening mediastinitis.

To ensure the lowest risk of perforation, many surgical centers have changed from CO₂ laser evaporation to the stapling technique, where the division of the septum is done by cutting in the middle of two rows of clips. The available staplers have wide jaws (≥12 mm) that make surgery difficult, especially in the narrow area of the hypopharyngeal space due to a limited view. The 5-mm width and blunt tip of the LigaSure (Covidien, Mansfield, MA) instrument constitutes an advantageous new tool for this endoscopic operation.

The LigaSure is an energy-based device that uses heat and pressure to coagulate and seal. It permanently fuses vessels up to and including 7 mm in diameter and tissue bundles without dissection or isolation. A knife inside the branches of the LigaSure can be activated afterward to divide the sealed tissue. The average seal cycle is 2 to 4 seconds. The sealing and cutting is performed in the same grip. The sealing is performed in the whole area between the jaws, whereas the cutting is performed in the middle until 2 mm from the tip (Fig. 1).
The LigaSure is widely used in laparoscopic surgery in both gastric and gynecological procedures. In some ear, nose, and throat centers, including ours, the LigaSure is used in thyroid surgery.

The purpose of this study was to assess the efficacy and safety of mucosal diverticulotomy for Zenker’s diverticulum using the LigaSure technique.

MATERIALS AND METHODS

Between December 2011 and September 2012, 15 consecutive patients were operated on using the LigaSure 5 mm to 37 cm blunt-tip instrument (Covidien, Mansfield, MA). Eight were males and seven were females, with a median age of 76 years (range, 52–87 years). All but one performed normal activities of daily living except for food intake. One had alcoholic dementia and lived in a nursing home. Symptoms were dysphagia and regurgitation, some had sleep disorders due to regurgitation, and four complained of cough and/or hoarseness.

All operations were performed under general anesthesia with oral intubation, and all were performed or supervised by either one of the two senior consultants committed to the project. In all cases, the Dohlmann rigid steel diverticuloscope (Karl Storz, Tuttingen, Germany) was placed with one branch in the diverticulum and the other in the esophagus, visualizing the septum in the middle between the branches (Fig. 2). Visualization on a monitor was further improved by inserting a digital fiberoptic laryngoscope inside the diverticuloscope connected to a video monitoring system. The depth of the diverticulum was measured from the beginning of the septum wall to the bottom of the diverticulum. The LigaSure instrument was inserted through the diverticuloscope, and the septum was coagulated and sealed laterally on both sides and then coagulated, sealed, and finally cut in the middle until 2 to 3 mm from the bottom of the diverticulum. The operation can be viewed at YouTube (http://youtube/p5nsd-iVNO).

In cases of large portions of the septum remaining toward the sides, they were coagulated and sealed with the LigaSure, but in contrast to the middle part, not divided. This subsequently resulted in shrinkage of the tissue due to evaporation and thereby a larger opening between the diverticulum and the esophagus. Patients were hospitalized and kept under observation overnight. Providing there were no complications such as thoracic pain or fever, oral intake of water was allowed 6 hours postoperatively. Soft food was allowed the day after surgery, and a normal solid diet was started after 7 days. Patients were scheduled for outpatient control after 2 to 8 weeks, and follow-up regarding diet and symptoms was conducted at median 9 months (range, 5–14 months) postoperatively. Further controls are scheduled 1 year postoperatively.

RESULTS

The median size of the Zenker’s diverticula was 3 cm (range, 2–7 cm). The median time spent for the diverticulotomies was 32.5 minutes (range, 14–72 minutes). The procedure lasting 72 minutes included surgery for another disease. The second longest surgery time was 44 minutes. This included the visualization of the diverticulum by normal rigid esophagoscopy, insertion of the diverticuloscope, the visualization on screen with the digital flexible laryngoscope, the surgical procedure, and the removal of instruments.

All patients but one (93%) could resume oral intake the first day after surgery. One patient had severe coughing attacks and vomiting immediately postoperatively, probably caused by intolerance to the postoperative treatment with morphine in the wake-up ward, and was hours later diagnosed with a perforation. The perforation was visualized with a barium contrast x-ray examination. The perforation was not visible during surgery. This resulted in a prolonged hospitalization with a nasogastric tube and intravenous treatment with broad-spectrum antibiotics. This patient’s diverticulum measured 3 cm. At follow-up, the patient was on a normal diet and was relieved of all symptoms. At primary follow-up 2 to 8 weeks postoperatively, all patients had normal food intake without any limitations. All patients but one (93%) were relieved of all symptoms. One patient had remarkable improvement of oral intake but had to chew food well. At later follow-up after 5 to 14 months, 12 patients reported normal dietary intake and were relieved of other symptoms such as hoarseness, regurgitation, and sleep impairment. One developed a

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new hoarseness and was submitted to phoniatic treatment. Two patients had recurrence of symptoms and were diagnosed with a relapse of the diverticulum. They are scheduled for reoperation. Another patient who was operated for an esophageal stricture in the esophagus prior to the diverticulectomy was diagnosed with a relapse of the stricture distal to the site of the diverticulum 7 months after the diverticulectomy. An endoscopic dilation is scheduled. One patient had normal dietary intake but had to drink more than others while eating, and a second patient with normal dietary intake experienced a tendency for beef not to pass smoothly. Four patients (27%) experienced postoperative thoracic pain and temperature rise to 38° to 39°C (~100°–102°F). One of these patients was the one diagnosed with a perforation of the esophagus. The symptoms disappeared within 24 hours in the remaining three patients without signs of perforation.

DISCUSSION

Zenker’s diverticulum is the most common type of esophageal diverticula, and although the exact incidence is difficult to determine because it can be completely asymptomatic, the incidence is reported as 2/100,000. However, the incidence of Zenker’s diverticulum is likely to increase due to the ageing of the population, especially in high-income countries.

Due to the relatively low incidence, comparative prospective studies are difficult to perform in the clarification of the optimal treatment. The diameter of the tip of the LigaSure instrument is 5 mm compared to 12 mm for the stapler. The small diameter of the LigaSure instrument enables a more sufficient overview in the endoscope. The diverticulum is furthermore visibly enlarged on a fiberoptic endoscopic video monitoring system creating an excellent overview (Fig. 2). Diverticulotomy using a stapler device or a laser has been the gold standard for many years, but the stapler is a difficult instrument to handle through an endoscope in the narrow anatomical spaces in the hypopharynx, and sometimes other instruments must be used. The large diameter of the stapler (≥12 mm) may obstruct visualization during surgery, and most surgeons find it beneficial only for diverticula deeper than 2 cm. Furthermore, the row of staples extend beyond the cutting opportunities by about 1 cm, leaving the distal part of the diverticulum uncut. Thus, some surgeons use the laser for the distal part of the septum after having divided the upper part using the stapler. The challenges using the CO₂ laser are that it is time consuming, and the depth of the laser evaporation can be difficult to assess. Furthermore, a microscope is necessary for this procedure. Therefore, several reports show a higher risk of recurrence, probably due to insufficient removal of the septum, and higher risk of esophageal perforation. By using the laser, there is practically no sealing of the tissue.

A Harmonic scalpel (Ethicon Endo-Surgery, Inc., Somerville, NJ) has been used in the treatment of Zenker’s diverticulum with good results. This instrument has about the same dimension as the LigaSure but uses ultrasonic energy to coagulate, seal, and cut the tissue in one procedure. Compared to LigaSure, this instrument does not allow expanding the sealing before cutting.

To the best of our knowledge, this is the first report that specifically underlined the advantage of using a LigaSure forceps in the treatment of Zenker’s diverticulum. In this study, 93% of all treated patients had complete immediate relief of all symptoms, and one patient (7%) had good improvement of oral intake. These results were very similar to other endoscopic techniques where relief of symptoms are reported in 90% to 100% of cases. However, diverticulectomy using the LigaSure instrument has the advantage that it is very easy to handle and makes the procedure more precise. Additionally, the procedure is less time consuming, allowing for minimization of postoperative discomfort for the patient and a shorter time spent under narcosis for the elderly patient group. The risk of operative and postoperative complications is seemingly low, and only a few patients experienced unsatisfactory results, which is in line with the other available endoscopic procedures for treating Zenker’s diverticulum.

This study has several limitations. First of all, it is a small study and serves mostly as a report of the availability of a new technique that seems to have some advantages. Another limitation is that the study had a very short observation time that will not show all relapses. However, a 1-year control is scheduled for all patients. We have now operated on 24 patients. The ones not included in the study have not been seen at the follow-up, but during admission there were no complications. Furthermore, the patients were not subject to a dysphagia or regurgitation score prior to surgery, which could have provided a more precise indication of the beneficial effects. In our opinion, the patients in this study are comparable to patients in other studies with regard to age, sex, symptoms, and size of the diverticula. All patients had severe impairment of food intake.

More information about preoperative symptoms and a longer follow-up time will be a subject in future studies, but to the best of our knowledge and according to our preliminary results and experience in implementing this new technique, using the LigaSure instrument in the treatment of Zenker’s diverticulum would be beneficial for the patients and the surgeons performing this procedure.

CONCLUSION

Endoscopic mucomyotomy of Zenker’s diverticulum using the LigaSure instrument seems to be a fast, safe, and easy method, but further studies are needed.

BIBLIOGRAPHY