ENDOSCOPIC STAPLER-ASSISTED ZENKER’S DIVERTICULOTOMY: WHICH IS THE BEST OPERATIVE FACILITY?

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Abstract: Background. Despite great changes in treatment for Zenker’s diverticulum, endoscopic stapler-assisted diverticulotomy (ESD) has not yet been included on the lists of possible day-case procedures, and determining the best operative facility is still a matter of debate. The aim of this article was to evaluate the safety and feasibility of endoscopic treatment for patients with Zenker’s diverticulum on a planned 24-hour-stay basis.

Methods. We retrospectively reviewed cases in which patients were admitted to and operated on at the Department of Airway Endoscopic Surgery of the Padua University Hospital over a 5-year period (January 2000 to December 2004).

Results. We considered 106 consecutive ESDs performed on 86 patients (1.23 procedures/patient). All procedures were planned on a 24-hour-stay basis (“1-day surgery”). In no case was the endoscopic procedure aborted. The mean operative time was 14 minutes (range, 5–45 minutes). Neither perioperative mortality nor major complications occurred. Minor complications were noted in 3 cases (2.8%). The mean time taken to resume oral intake was 0.83 days (range, 0–1). The mean hospital stay was 1.06 days (range, 0–5). Ninety-nine patients (93.4%) were discharged within the 24 hours after surgery. In no case was readmission necessary.

Conclusions. We believe that ESD is a suitable operation for 1-day surgery. This facility, in fact, ensures the same outcome and safety conditions as with the inpatient procedure, making it possible to rationalize health resource management, reduce hospital costs, and improve patient comfort. In selected cases, ESD could be performed on an outpatient basis. © 2006 Wiley Periodicals, Inc. Head Neck 28: 1084–1089, 2006

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Zenker’s diverticulum is a mucosal pouch bulging from the posterior hypopharyngeal wall, between the fibers of the inferior constrictor and the cricopharyngeal muscles (Killian’s triangle). Although the first anatomical report of a hypopharyngeal diverticulum was made by Ludlow1 in 1769, Zenker’s diverticulum takes its name from the German pathologist Friedrich Albert Zenker,2 who described the pathologic and clinical features in 1878. Dysphagia, regurgitation, and persistent cough are typical symptoms that indicate the need for treatment.

Several surgical approaches have been proposed for the treatment of Zenker’s diverticulum, but the standard transcutaneous procedure is diverticulectomy through cervicotomy, with or without myotomy of the cricopharyngeal muscle.3,4 Myotomy alone may be sufficient for small diverticula.5,6 Mosher7 first described the endoscopic division of the wall between the pouch and the esophag-
gus in 1917, but this approach was eventually abandoned because of the high incidence of mediastinitis. Endoscopic diverticulotomy was reintroduced about 50 years later, during the postantibiotic era, by Dohlman and Mattson, who used a diathermic coagulator to cut the common wall. At the beginning of the 1990s, Collard et al in Belgium, Martin-Hirsch and Newbegin in England, and our group in Italy introduced the use of an endoscopic stapler to divide and suture the septum between the pouch and the cervical esophagus. This technique not only permits the partial section of the upper esophageal sphincter fibers but also allows the opening of the diverticulum in the esophageal lumen, simultaneously suturing the surgical edges (esophagodiverticulostomy).

Over the years, endoscopic stapler-assisted diverticulotomy (ESD) has proved safer than, and as effective as, the open procedures, with a significant reduction in morbidity, complication rate, and hospitalization stay. These results induced us to consider an alternative to inpatient admission for treating patients with Zenker's diverticulum in an attempt to rationalize health resources and reduce hospital costs.

PATIENTS AND METHODS

Between March 1992 and December 2004, 435 consecutive patients underwent ESD at the Padua and Milan University Hospitals. This group consisted of 297 men and 138 women, with an age range of 38 to 92 years (mean, 66 years); 93% of the procedures were performed by the senior author (SN).

For uniformity of treatment, in this study we considered only those patients admitted to, and operated on, in the Department of Airway Endoscopic Surgery at Padua University Hospital during the previous 5 years (January 2000 to December 2004). During this period, 106 consecutive ESD procedures were carried out on 86 patients with Zenker’s diverticulum. For each one, a retrospective review of the medical record was made: demographic and clinical data were noted, including age, sex, and origin; previous surgical treatment; comorbid conditions; size and characteristics of diverticulum; operative time and number of staple cartridges required; perioperative complications; time for resumption of oral intake; and length of hospital stay.

Procedure. A barium swallow study was performed on all patients before surgery (Figure 1). All the procedures were performed with the patient under general anesthesia, as previously described. The diverticulum was exposed with use of a Weerda bivalved diverticuloscope (Karl Storz, Tuttingen, Germany) placed in the hypopharynx, with the superior blade into the esophageal lumen and the inferior one into the diverticulum, so as to isolate the common septum. After food debris was removed by washing and suctioning, the mucosa was carefully inspected with a 0°
telescope, and the depth of the diverticulum was evaluated with a graduated probe (Figure 2).

Esophagodiverticulostomy was performed by means of a linear cutting stapler (Endopath ETS 35; Ethicon Endo-Surgery, Jonhson & Johnson, Cincinnati, OH). This device permits simultaneous sectioning and suturing of the septum between pouch and esophagus, creating a common cavity (Figure 3). Multiple applications may be necessary, depending on the size of diverticulum. A straight endoscopic scissor was used to complete the section up to the distal end of the staple line (Figure 4). Finally, the hypopharynx was irrigated with saline solution and the suture line was checked for hemostasis. The entire procedure was carried out under magnified endoscopic visualization and recorded on a digital custom-implemented system (MS Software, Treviso, Italy).

A regular oral diet was restarted after a barium swallow study excluded an esophageal leakage; the patient was then discharged.

Each patient underwent clinical evaluation 3 months after ESD. If symptoms were still present, or had not significantly improved, an esophageal radiogram was carried out to assess the persistence or recurrence of the diverticulum. Afterward the patients were asked to contact us and repeat the barium swallow if symptoms arose again.

**RESULTS**

We considered 106 consecutive ESDs performed on 86 patients (1.23 procedures/patient; 56 men and 30 women). The age range was 40 to 91 years (mean, 67 years). Fifty-eight patients (67.4%) came from outside the Veneto region (more than 2 hours by car).

All the patients were symptomatic; the main symptoms were dysphagia and regurgitation, followed by cough and recurrent pneumonia. The average length of diverticulum was 3.8 cm (range, 2–9 cm). In 5 cases the diverticulum was recurrent after “open surgery,” whereas 7 patients had previously undergone endoscopic treatment, 5 of them at other institutions. In 2 cases, the diverticulum was anterior, 1 of which was subsequent to a pharyngeal reconstruction with pectoral major flap for neoplastic disease. One patient had previously undergone a supraglottic laryngectomy with arytenoidectomy for laryngeal cancer. Another patient was affected by advanced Parkinson’s disease. One patient presented with a significant reduction in cervical extension caused by rachis disease.

In none of the 106 cases was the endoscopic procedure aborted because of difficulty in exposing the diverticulum or performing the esophagodiverticulostomy. The mean operating time was 14 minutes (range, 5–45 minutes); in every case, the most time
was spent placing the diverticuloscope correctly. According to the length of diverticulum, only 1 stapler cartridge was used in 62 patients with diverticula up to 3 cm long; 2 cartridges in 40 patients with diverticula of 3 to 5 cm; and 3 cartridges in 3 patients with diverticula of 5 to 7 cm. In 1 case, with a 9-cm-long diverticulum, the treatment was planned in 2 stages at an interval of 3 months between them.

In only 1 case was a nasogastric probe positioned because of suspected intraoperative mucosal laceration. The Gastromiro swallowing radiogram, carried out during the early hours after the operation, excluded an esophageal perforation, and the probe was immediately removed.

Neither perioperative mortality nor major complications occurred, including perforations, mediastinitis, aspiration pneumonia, and subcutaneous emphysema. Minor complications were noted in 3 cases (2.8%). A tooth fracture occurred intraoperatively in 2 patients; postoperative fever occurred in another patient.

All patients resumed a normal diet within 24 hours after surgery, when a barium swallow radiogram ruled out esophageal perforation. The mean time for oral intake was 0.83 days (range, 0–1 day).

The mean hospital stay was 1.06 days (range, 0–5 days). Ninety-nine of 106 patients (93.4%) were discharged within 24 hours after surgery with overnight hospitalization at most (1-day surgery). In 7 patients who underwent the procedure in the morning, it was possible to perform the radiological control and then to resume the oral diet on the same day as the surgery. Only 3 of these, when asked, preferred to be discharged the same day. Seven patients (6.6%) were discharged later than the first day after the operation. In 1 of these cases, discharge was delayed up to the fifth day after the operation, because the patient’s temperature was elevated. One patient, who complained of chest pain after surgery, was discharged on the second day after the operation after a myocardial infarction had been ruled out by electrocardiogram. Another 5 patients were discharged on the second day strictly for logistical reasons. In no case was a readmission necessary.

The mean follow-up was 7.3 months (range, 3–54 months). Every patient has had complete resolution or significant improvement of symptoms. In 17 patients (19.8%), repeat treatment was needed because of persistence or recurrence of a symptomatic diverticulum (2 procedures in 14 patients, 3 procedures in 3 patients). The mean time elapsing between subsequent procedures was 15 months (range, 3–50 months). No increase in operation time, complications, time to oral intake, and hospital stay was noted in revision surgery.
DISCUSSION

Despite great changes in treatment for Zenker's diverticulum, ESD is not yet included on the lists of possible day-case procedures. On the basis of our experience, we consider this operation suitable for a planned 24-hour stay (1-day surgery). The stapler-assisted endoscopic treatment of Zenker's diverticulum, in fact, completely meets the guidelines for day based surgery; in particular, day-case ESD ensures the same outcome and safety conditions as does the inpatient procedure, making it possible to rationalize health resource management and reduce hospital costs, and thereby accept more patients. Even so, the following issues are, in our opinion, of paramount importance.

First, a careful selection of patients is mandatory. The feasibility of the 24-hour-stay facilities was evaluated for each case on the basis of clinical and social considerations. In case of an adverse perioperative event, the patient was admitted on an inpatient basis.

Second, the patients were given detailed, comprehensible information when surgery was proposed. General information of a logistical nature and specific information about the surgical procedure and the preoperative and postoperative period were discussed with the patients so that they could express their informed consent.

Third, a case file was compiled for all planned 24-hour cases. Demographic and clinical data were noted; all the procedures performed were reported. The operation was carried out under magnified endoscopic visualization. The images, recorded on a digital system, can be reevaluated and shared with other physicians or, if necessary, with the general practitioner.

Fourth, a detailed clinical report was delivered after each patient's readiness for discharge was assessed. The significant data regarding the procedure, expected outcome, possible complications, therapy, time, and method of the subsequent checks were reported. A contact telephone number was issued to each patient, in the event that assistance was required.

All patients considered were planned on a 24-hour-stay basis with a possible overnight hospitalization. This facility, in our experience, is justified on both clinical and organizational grounds. It is important to bear in mind that, even though ESD is characterized by a low rate of complication (0% to 33% reported in the literature; 2.8% in this study), serious, even fatal, complications such as perforation with consequent mediastinitis can occur. For this reason, all patients underwent a barium swallow study before a regular oral diet was resumed; nevertheless, in none of the reported cases was a perforation noted.
Therefore, to reduce the time before oral intake and hospital costs, it is our current policy to perform a radiographic assessment only if an esophageal lesion is suspected. Also in this case, the possibility of overnight observation permits most signs and symptoms of major complications to be ruled out.

Recent publications\textsuperscript{12,18} state the feasibility of the endoscopic diverticulotomy as an outpatient procedure. We agree with the authors, but it must be highlighted that a freestanding ambulatory procedure is suitable only for a restricted percentage of patients. In particular, the most detailed article\textsuperscript{18} reports that 20\% of patients were excluded from the outpatient facilities, and more than 22\% of patients treated on an outpatient basis required unexpected admission. In our experience, all the patients were considered suitable for 1-day surgery, and only 2 (1.88\%) had a delayed discharge for clinical reasons (fever and chest pain). Logistical reasons should be considered as well, with 67.4\% of our patients from outside the Veneto region. Five of these patients were discharged on the second day after operation, as it was not possible to coordinate timely transportation.

Another reason supporting the overnight possibilities is the patient’s age: 44\% of patients in this series were older than 70 years. Even if no differences in operation time, complication rate, time to oral intake, and hospital stay were observed, the older patients often required a longer recovery time in contraindication to the freestanding procedure. Therefore, in our opinion, the outpatient facilities can be advocated only for patients younger than 70 years without significant comorbidity (eg, cardiovascular disease, recurrent pneumonia, dementia) and with favorable social and logistical conditions (eg, availability of a healthy home environment, effective assistance, availability of a telephone, access to the hospital within less than 1 hour). However, patient selection for freestanding ESD should be made by the physician on a case-by-case basis, also considering the patient’s preference.\textsuperscript{18}

\section*{CONCLUSIONS}

Technical advances in Zenker’s diverticulum surgery have dramatically changed the approach to this disease. ESD has proved, in experienced hands, to be minimally invasive, safer and as effective as the standard open procedures, with a significant reduction in operating time, complication rate and hospitalization.\textsuperscript{12,14}

In our experience, this procedure was considered suitable for a 24-hour stay in all cases with a minimum rate of delayed discharge and without the need of readmission. For these reasons, we believe that 1-day surgery is the best operative facility for ESD permitting improvement in medical resource management and patient comfort. Patients younger than 70 years, in good clinical condition, without social and logistical problems could be candidates for ESD on an outpatient basis. The possibility of unexpected admission should always be considered.

\section*{REFERENCES}