Case Report

ANNALS OF MEDICINE & SURGERY

OPEN

Emergency esophagectomy for esophageal perforation following balloon dilation due to stenosis post-endoscopic submucosal dissection for esophageal cancer: a case report

Binh Van Pham, MD, PhD[a,*], Duy Duc Nguyen, MD[b], Manh Dai Tran, MD[b], Thanh Duy Nguyen, MD[b], An Duc Thai, MD[b], Hoa Thi Thanh Nguyen, MD[c,*]

Introduction and importance: Esophageal perforation from endoscopic dilation is rare (0.53–0.6% incidence) but serious, with mortality rates of 12.5–20%. Optimal treatment is debated and depends on the medical facility's capabilities, the patient's symptoms, the extent of perforation, and the severity of associated lesions. Treatment options include medical management (fasting, antibiotics), esophageal stenting, surgical closure, or emergency esophagectomy. Early diagnosis and treatment are crucial to reduce mortality and hospital stay.

Case presentation: A 49-year-old male with lower third esophageal cancer (stage cT1aN0M0) underwent endoscopic submucosal dissection (ESD) and developed esophageal stenosis. Dilation attempts led to esophageal perforation, necessitating emergency esophagectomy with gastric conduit reconstruction. The patient improved and was discharged on day 10 post-operation without complications.

Clinical discussion: Managing esophageal perforation post-endoscopic dilation is complex. This case highlights the importance of rapid recognition and intervention. Esophageal dilation, while effective for stenosis, carries a perforation risk. Treatment decisions must be tailored to individual patients, considering perforation severity, patient's health, and facility resources. Here, severe perforation and clinical condition warranted emergency esophagectomy. The successful outcome underscores the efficacy of this surgical intervention when performed timely at specialized centers.

Conclusion: Emergency esophagectomy with gastric conduit reconstruction for treating esophageal perforation due to stenosis post-endoscopic submucosal dissection for esophageal cancer is considered a safe procedure and can be performed at an experienced esophageal surgery center.

Keywords: esophageal cancer, esophageal perforation, emergency esophagectomy, case report

Introduction

Esophageal perforation is a rare but life-threatening injury with diverse causes, including endoscopic procedures, endotracheal tube placement, gastric tube insertion, gastrointestinal foreign bodies, barotrauma, and spontaneous esophageal perforation (Boerhaave syndrome). Additionally, causes related to chest trauma or iatrogenic injury have been reported[1]. Endoscopic procedures are the most frequent cause of iatrogenic esophageal perforation[2]. Esophageal perforation due to endoscopic dilation is considered a rare complication, occurring at a rate of 0.53–0.6% per intervention.

Currently, the introduction of endoscopic mucosal resection (EMR) or endoscopic submucosal dissection (ESD) for early esophageal cancer treatment has offered new solutions but has also increased the incidence of esophageal stricture. Two independent risk factors for perforation during dilation therapy for post-EMR/ESD stenosis have been identified: the number of dilations and the site of the stricture[3]. Currently, there is controversy in choosing the optimal treatment method for esophageal perforation due to endoscopic dilation, as it involves many factors. Considerations include the capabilities of the medical facility, the patient's symptoms, the extent of the esophageal perforation, and the severity of associated lesions. Treatment options can include conservative management (fasting, antibiotics), placement of an esophageal stent, surgical closure of the perforation, and in severe cases, emergency esophagectomy.

We report this case with the aim of reviewing the literature on esophageal perforation following ESD, as well as the indications for emergency esophagectomy in cases of esophageal cancer.

We present the following case in accordance with the SCARE 2023[4].

[a]Abdominal Surgery Department 1 and Robotic Surgery Center, Vietnam National Cancer Hospital, Hanoi, Vietnam, [b]Abdominal Surgery Department 1, Vietnam National Cancer Hospital, Hanoi, Vietnam and [c]Clinical Nutrition Center, Vietnam National Cancer Hospital, Hanoi, Vietnam

*Corresponding author. Address: Abdominal Surgery Department 1 and Robotic Surgery Center, Vietnam National Cancer Hospital, Hanoi, Vietnam, 30 Cau Buou Road, Thanh Tri District, Hanoi 12511, Vietnam. Tel.: +84 904 145 909. E-mail: binhva@yahoo.fr (B.V. Pham); Clinical Nutrition Center, Vietnam National Cancer Hospital, 30 Cau Buou Road, Thanh Tri District, Hanoi, Vietnam. Tel.: +84 852 811 992. E-mail:dr.peace2801@gmail.com (H.T.T. Nguyen).

Sponsorships or competing interests that may be relevant to content are disclosed at the end of this article.

Annals of Medicine & Surgery (2024) 86:6766–6771

Received 23 July 2024; Accepted 30 August 2024

Published online 20 September 2024

http://dx.doi.org/10.1097/MS9.0000000000002573

Case presentation

A 49-year-old male with no significant medical history was admitted to the hospital after a routine examination revealed a lesion in the middle and lower third of the esophagus. The lesion was located 28–33 cm from the upper incisor, characterized as Paris 0–IIb type, and occupying more than three-quarters of the circumference (Fig. 1). Endoscopic ultrasound indicated that the lesion originated from the mucosa, submucosal layer, and muscle layer was assessed relatively undamaged. The lymph node detected was small, resulting in a stage of cT1aN0M0. Computed tomography scan of the chest and abdomen confirmed these findings. Subsequently, the patient underwent endoscopic submucosal dissection (ESD). The procedure was successful, and pathology results revealed squamous cell carcinoma stage pT1aN0M0 with negative resection margins. However, ~3 weeks post-procedure, the patient developed dysphagia classified as level I according to Saeed's classification[5] (difficulty swallowing liquids and inability to swallow solids). Esophagogastroduodenoscopy revealed stenosis involving the entire circumference of the esophagus (Fig. 2).

The patient underwent esophageal dilation with a 12 mm balloon under endoscopy. However, within one hour after the procedure, the patient developed severe dyspnea, tachypnea, tachycardia, cyanosis, with an Oxygen saturation (SpO2) of 90%. A chest X-ray revealed a left-sided tension pneumothorax with mediastinal shift to the right (Fig. 3). The elevated white blood cell count and CRP levels, exceeding 15 G/l and 150 mg/l, respectively, indicate an ongoing infection. Esophagogram demonstrated leakage of contrast agent from the lower third of the esophagus (Fig. 4). Subsequently, the patient was diagnosed with esophageal perforation following the esophageal dilation procedure. After a while, he received strong antibiotics (Meropenem Kabi 1 g given every 8 h), intravenous fluids, and fasting.

Six hours after the procedure, we opted to proceed with emergency esophagectomy using thoracoscopy with five trocars placed in the right chest. Upon assessment, ~20 ml of cloudy fluid was found in the pleural space. The lower third of the esophagus exhibited a thickened wall and a 1×1.5 cm full-thickness perforation that could not be conservatively sutured (Fig. 5). The damage was evaluated as moderate, early stage, with no pseudomembrane formation in the pleura. Therefore, we decided to perform minimally invasive emergency esophagectomy with gastric conduit reconstruction and cervical anastomosis. Postoperatively, the patient remained stable with no complications such as mediastinal infection, gastric tube necrosis, or pneumonia. Postoperative results revealed an inflammatory necrotic lesion, with no residual tumor in the specimen, along with the dissection of 22 lymph nodes. A contrast esophagogram on the 7th day post-operation showed no obstruction or leakage (Fig. 6). Bilateral pleural chest tubes were removed on the 8th day, and the patient was discharged from the hospital 10 days postoperative.

HIGHLIGHTS

- Emergency esophagectomy with gastric conduit reconstruction for the treatment of esophageal perforation due to stenosis after ESD for esophageal cancer is a safe procedure and can be performed at an experienced esophageal surgery center.
- Currently, the development of endoscopic mucosal resection (EMR) or endoscopic submucosal dissection (ESD) in the treatment of early esophageal cancer patients has led to a new solution for esophageal cancer. However, the number of esophageal strictures after these endoscopics procedures has also increased. The esophageal perforation during dilation therapy for post-EMR/ESD stenosis is a rare injury and can be life-threatening. Treatment methods for the esophageal perforation can include medical treatment (fasting, antibiotics), esophageal stent placement, suture of the perforation, and emergency esophagectomy.
- Although esophagectomy is one of the most complicated and demanding procedures among all gastrointestinal surgeries, it can be performed in the context of emergency patients with esophageal perforation.
- In the situation of the perforation post-esophageal dilation due to stenosis after EMR/ESD, esophagectomy should be performed if there is complete stricture of the esophagus, as well as perforated lesions on malignant pathology. However, this should be carried out at experienced centers and the patient's clinical condition remains acceptable.

Discussion

Endoscopic interventions for the management of esophageal stenosis carry a potential risk of adverse events. Esophageal perforation due to endoscopic dilation is considered one of the

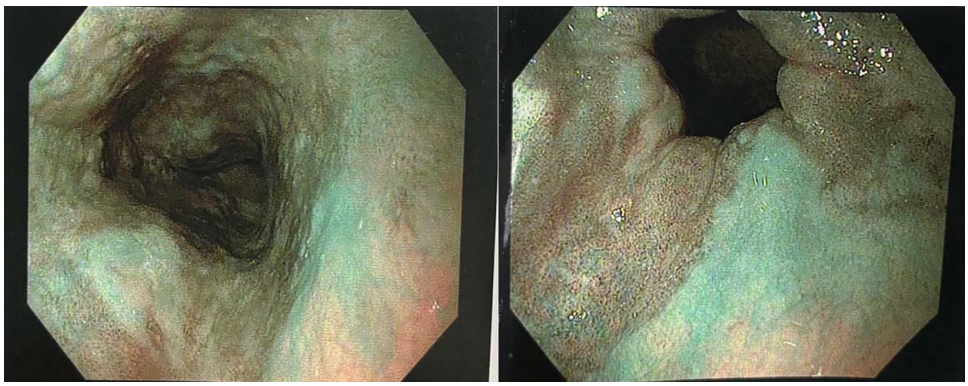

Figure 1. A middle and lower third esophageal cancer with the pathology being squamous cell carcinoma.

Figure 2. Stenosis of the entire esophageal lumen after endoscopic submucosal dissection (left) and after dilation (right).

rare adverse events, with a rate of 0.53–0.6% per intervention[6,7]. However, the consequences are severe, with a mortality rate of 12.5–20%[8]. Common risk factors associated with esophageal perforation due to dilation include chemical or malignant lesions[7].

Our patient was admitted to the hospital with a lesion occupying more than three-quarters of the esophageal circumference and staging still in the mucosal layer on the endoscopic ultrasound (cT1a). The Japanese Esophageal Society (JES) guidelines still allow performing ESD resection for lesions that do not occupy the entire circumference of the esophagus[9]. Nevertheless, corresponding to the level of circumference occupancy, the rate of stenosis after ESD resection gradually increases: from 28% of cases with lesions occupying ½–¾ of the circumference, to 94% in patients with lesions occupying > ¾ of the circumference[10], and increases to 88–100% in patients with lesions occupying the entire or nearly entire circumference[11].

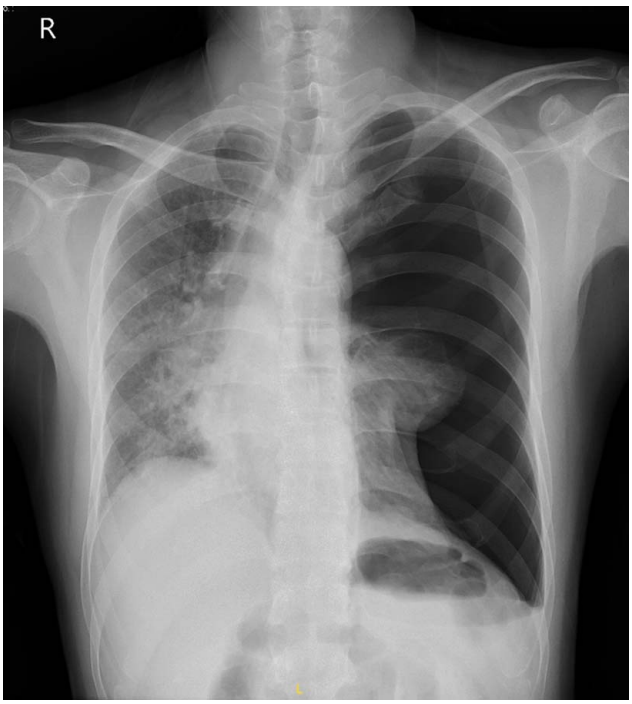

Figure 3. Image of left-sided tension pneumothorax associated with mediastinal shifts to right-side.

Prevention of esophageal strictures after ESD is crucial to ensure a satisfactory prognosis and quality of life for the patient. JES strongly recommends treatment with oral prednisolone, submucosal triamcinolone injection, or a combination of both methods. Although our patient received oral prophylactic prednisolone, strictures still occurred around the entire circumference of the esophagus. Other authors have also reported rates of esophageal stenosis after ESD in patients with lesions occupying more than three-quarters of the circumference, despite prednisolone treatment, with rates ranging from 8.6 to 23.1%[12,13]. Despite the JES recommendations, steroid therapy remains controversial in its effectiveness at preventing esophageal stenosis after ESD. Hirdes *et al.*[14] have shown that local steroid injection plus esophageal dilation did not significantly reduce the frequency of dilation or prolong the time without dysphagia in patients with esophagogastric anastomotic stricture.

The diagnosis of esophageal perforation following endoscopic dilation was firmly established with the presence of tension pneumothorax and contrast leakage on the esophagogram. Immediate pleural drainage was essential to relieve mediastinal compression and manage respiratory failure. The patient received strong antibiotics, intravenous fluids, and fasting. Due to complete esophageal stricture, malignant pathology with perforated lesions[15], and significant tissue damage, conservative treatments like pleural drainage with endoluminal vacuum-assisted therapy or suturing were not feasible. Emergency esophagectomy was deemed necessary. After left pleural drainage and antibiotic therapy, the patient showed a moderate response with no severe infection, supporting this decision. Gastric conduit reconstruction with cervical anastomosis was performed to mitigate the risk of anastomotic leakage into the mediastinum and prevent complicated thoracic infections. Postoperatively, the gastric tube was retained for 1 week and pyloric dilatation was performed to prevent delayed gastric emptying syndrome and minimize the risk of gastric conduit leakage. The patient recovered well postoperative with no signs of infection or respiratory failure. A follow-up esophagogram with a contrast agent confirmed no obstruction or leakage, and the patient was discharged from the hospital 10 days after the operation.

Regarding prognosis, the reported mortality rate for esophageal perforation ranges from 10 to 25% when treatment is initiated within 24 h of perforation. However, this rate may

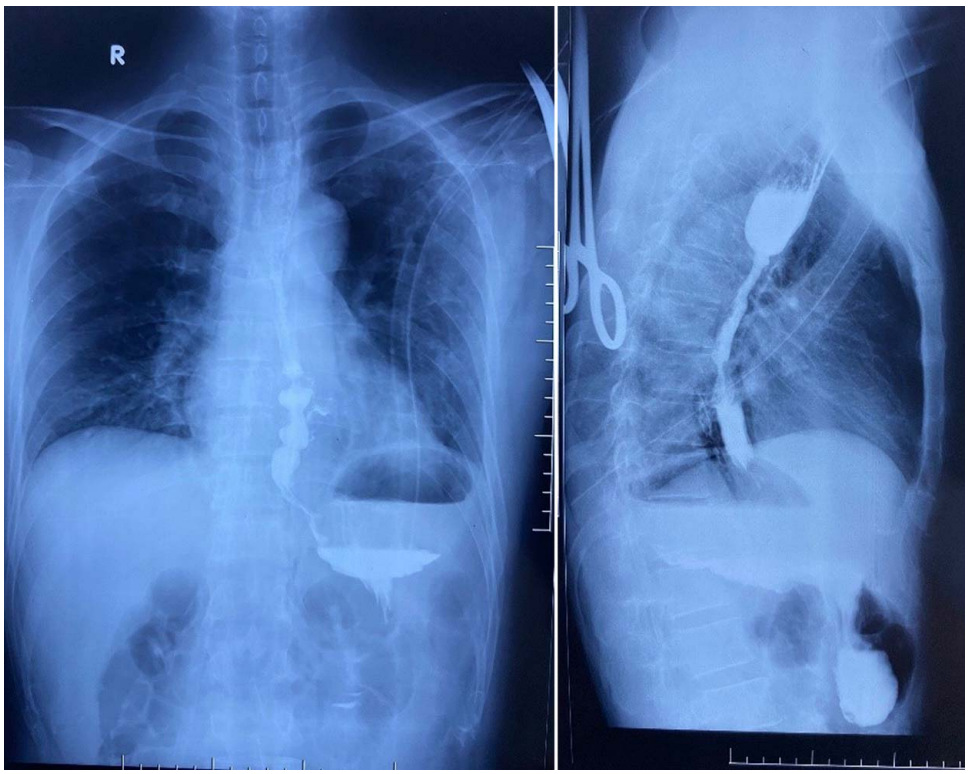

Figure 4. Escape of contrast agent from the lower third esophagus on the esophagogram.

increase to 40–60% when treatment is delayed beyond 48 h[16]. Early diagnosis, as reported by Amudhan and colleagues, reduces mortality and hospital stays associated with esophageal perforation[17]. Timely intervention decreases the likelihood of severe complications such as septic shock and esophageal necrosis, ensuring the patient's clinical condition remains stable and improving prognosis. Therefore, to mitigate the risks of iatrogenic esophageal perforation, it is crucial to perform esophageal dilation procedures at large centers capable of closely monitoring patients before, during, and after the procedure, with adequate resources for prompt surgical intervention when necessary.

Our hospital has extensive experience with over 500 cases of minimally invasive esophagectomy and is one of Vietnam's leading centers for esophageal endoscopy procedures. Therefore, we maintain consistent post-intervention monitoring and early management of abnormal cases. Globally, there is limited literature on emergency esophagectomy and gastric tube reconstruction for treating esophageal perforation. Wang *et al.*[18] reported a similar case where emergency esophagectomy was performed in a patient with esophageal stricture following ESD for esophageal cancer.

Conclusion

Perforation following esophageal dilation due to stenosis after ESD is a serious and dangerous complication that can lead to respiratory failure, mediastinitis, sepsis, empyema, and other severe outcomes, with a high mortality rate even when promptly diagnosed and managed. Emergency esophagectomy to address perforation post-esophageal dilation is a feasible and safe surgical option when conducted at an experienced esophageal surgery center.

Ethical approval

This study was conducted with the informed consent of the patient and received the requisite ethical approval from the Scientific Council of Vietnam National Cancer Hospital. The council comprises expert representatives from relevant specialties, including gastrointestinal surgeons, radiologists, oncologists, gastroenterologists, and pathologists. Their comprehensive review and endorsement ensured adherence to the highest ethical standards throughout the research process. Our procedures adhered to the Declaration of Helsinki. The authors reported no conflicts of interest.

Consent

The patient agreed to participate in the study. Written informed consent was obtained from the patient for publication and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Source of funding

Not applicable.

Conflicts of interest disclosure

The authors declare no conflicts of interest.

Figure 5. Image showing the perforation site on the esophageal wall in the postoperative specimen.

Author contribution

Conception and design: B.V.P., D.D.N., M.D.T., A.D.T.; Administrative support: B.V.P., M.D.T., T.D.N., H.T.T.N.; provision of study materials of patients: B.V.P., T.D.N., A.D.T., H.T.T.N.; collection and assembly of data: B.V.P., T.D.N., A.D.T., H.T.T.N.; data analysis and interpretation: B.V.P., A.D.T., D.D.N., H.T.T.N.; manuscript writing: all authors; final approval of manuscript: all authors.

Research registration unique identifying number (UIN)

Not applicable.

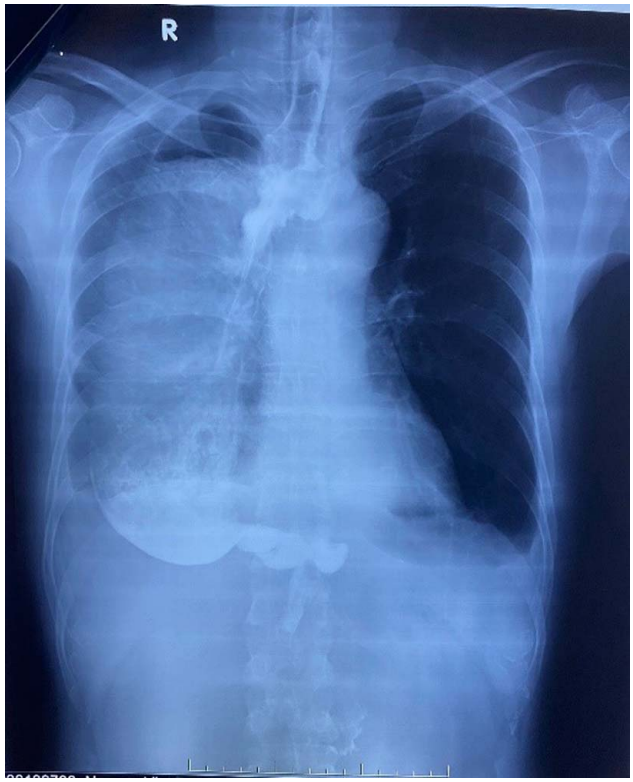

Figure 6. Esophagogram 1 week postoperative.

Guarantor

Binh Van Pham.

Data availability statement

Not applicable.

Provenance and peer review

Not applicable.

References

[1] Shahriarirad R, Karoobi M, Shekouhi R, *et al*. Esophageal perforation etiology, outcome, and the role of surgical management—an 18-year experience of surgical cases in a referral center. BMC Surg 2023;23:177.
[2] Kaman L, Iqbal J, Kundil B, *et al*. Management of esophageal perforation in adults. Gastroenterol Res 2010;3:235–44.
[3] Takahashi H, Arimura Y, Okahara S, *et al*. Risk of perforation during dilation for esophageal strictures after endoscopic resection in patients with early squamous cell carcinoma. Endoscopy 2011;43:184–9.
[4] Sohrabi C, Mathew G, Maria N, *et al*. The SCARE 2023 guideline: updating consensus Surgical CAse REport (SCARE) guidelines. Int J Surg Lond Engl 2023, 109:1136.
[5] Saeed ZA, Winchester CB, Ferro PS, *et al*. Prospective randomized comparison of polyvinyl bougies and through-the-scope balloons for dilation of peptic strictures of the esophagus. Gastrointest Endosc 1995; 41:189–95.
[6] Hagel AF, Naegel A, Dauth W, *et al*. Perforation during esophageal dilatation: a 10-year experience. J Gastrointest Liver Dis JGLD 2013;22:385–9.
[7] Zhou WZ, Song HY, Park JH, *et al*. Full-thickness esophageal perforation after fluoroscopic balloon dilation: incidence and management in 820 adult patients. Am J Roentgenol 2015;204:1115–9.

[8] Benites-Goñi HE, Arcana-López R, Bustamante-Robles KY, *et al*. Factores asociados a complicaciones en las dilataciones esofágicas endoscópicas. Rev Esp Enfermedades Dig 2018;110:440–5.
[9] Kitagawa Y, Ishihara R, Ishikawa H, *et al*. Esophageal cancer practice guidelines 2022 edited by the Japan esophageal society: part 1. Esophagus 2023;20:343–72.
[10] Shi Q, Ju H, Yao LQ, *et al*. Risk factors for postoperative stricture after endoscopic submucosal dissection for superficial esophageal carcinoma. Endoscopy 2014;46:640–4.
[11] Yamamoto Y, Kikuchi D, Nagami Y, *et al*. Management of adverse events related to endoscopic resection of upper gastrointestinal neoplasms: review of the literature and recommendations from experts. Dig Endosc 2019;31:4–20.
[12] Kitagawa Y, Ishihara R, Ishikawa H, *et al*. Esophageal cancer practice guidelines 2022 edited by the Japan esophageal society: part 1. Esophagus 2023;20:343–72.
[13] Zhou G, Yuan F, Cai J, *et al*. Efficacy of prednisone for prevention of esophageal stricture after endoscopic submucosal dissection for superficial esophageal squamous cell carcinoma. Thorac Cancer 2017;8:489–94.
[14] Hirdes MM, van Hooft JE, Koornstra JJ, *et al*. Endoscopic corticosteroid injections do not reduce dysphagia after endoscopic dilation therapy in patients with benign esophagogastric anastomotic strictures. Clin Gastroenterol Hepatol 2013;11:795–801.
[15] Kaman L, Iqbal J, Kundil B, *et al*. Management of esophageal perforation in adults. Gastroenterol Res 2010;3:235.
[16] Iqbal Kaman L, Kundil J, Kochhar BR. Management of esophageal perforation in adults. Gastroenterol Res 2010;3:235–44.
[17] Pace F, Antinori S, Repici A. What is new in esophageal injury (infection, drug-induced, caustic, stricture, perforation)? Curr Opin Gastroenterol 2009;25:372–9.
[18] Wang WP, Ni PZ, Yang JL, *et al*. Esophagectomy after endoscopic submucosal dissection for esophageal carcinoma. J Thorac Dis 2018;10:3253–61.