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Original Article

Polyglycolic acid sheet plus esophageal stent presents with higher efficacy in preventing esophageal stricture post endoscopic submucosal dissection compared with stent placement alone in early-stage esophageal cancer patients

Yanguo Yang*, Chufei Liu*, Junhua Hu, Guangxin Lu

*Department of Gastroenterology, Renmin Hospital, Hubei University of Medicine, Shiyan, Hubei, P.R. China. *Equal contributors.*

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Abstract: This study aimed to investigate the effect of polyglycolic acid (PGA) plus stent therapy compared with stent alone therapy on preventing post-endoscopic submucosal dissection (ESD) esophageal stricture in patients with early-stage esophageal cancer (EC). This prospective cohort study recruited 75 patients who underwent ESD for early-stage EC, including 38 patients who received PGA plus stent therapy (PGA+stent group) and 37 patients who received only stent placement (stent group). Incidence of postoperative stricture after esophageal ESD, the days to esophageal stricture, location, length and diameter of esophageal stricture as well as balloon dilatation times for the esophageal stricture were evaluated. 13.2% (n = 5) patients in PGA+stent group developed esophageal stricture, which was lower compared with stent group (35.1% (n = 13), P = 0.026). In the patients with esophageal stricture, length of esophageal stricture in PGA+stent group was numerically shorter than that in stent group (P = 0.050). While no difference in time to esophageal stricture (P = 0.286), diameter of esophageal stricture (P = 0.103), esophageal stricture distance from the incisions (P = 0.917) or balloon dilatation time (P = 0.173) was found between PGA+stent group and stent group. In addition, Multivariate logistic regression analysis revealed that PGA+stent (vs. stent, P = 0.021) was an independent predictive factor for lower possibility of esophageal stricture. In conclusion, PGA plus stent placement therapy achieved lower occurrence of post-ESD esophageal stricture as well as numerically lighter esophageal stricture severity compared with stent placement therapy alone in early-stage EC patients.

Keywords: Esophageal cancer, esophageal stricture, polyglycolic acid, stent

Introduction

Esophageal cancer (EC), as a type of the aggressive cancers worldwide, has been regarded as a high-mortality disease which causes 400,200 deaths in 2012 according to 2015 global cancer statistics [1, 2]. For the development of endoscopic treatment, endoscopic submucosal dissection (ESD), an efficient, safe and curative treatment for superficial EC, allows en bloc resection of lesions regardless of tumor size [3, 4]. Nevertheless, some post-ESD complications affect the quality of life in EC patients, especially esophageal stricture that frequently occurs following ESD and leads to dysphagia [5, 6]. Thus, effective prevention for post-ESD esophageal stricture is of great importance. With this object, some prophylactic measures for post-ESD esophageal stricture have been developed in clinical practices. For example, steroids injection is widespread used due to the easy technique, while there are some adverse events such as delayed esophageal perforation and reactivation of hepatitis B, which have been concerned [7-9]. As to stent placement, it is known as a safe and effective operation for esophageal stricture patients, whereas its complications still exist including severe hemorrhage, esophageal perforation, stent migration and fracture [10-13]. In recent years, polyglycolic acid (PGA) sheet, which prevents scarring and contraction after partial glossectomy and

is applied as an absorbable suture stiffener material in other surgeries, has demonstrated its potential in preventing post-ESD esophageal stricture, while the early detachment of PGA sheet limits its efficacy in prophylactic application [3, 14].

Based on aforementioned characteristics of prophylactic methods for post-ESD esophageal stricture, we hypothesized that PGA plus stent placement might present with good efficacy in preventing esophageal stricture. Therefore, this present study aimed to investigate the efficacy of PGA plus stent therapy compared to stent placement alone therapy on preventing post-ESD esophageal stricture in patients with early-stage EC.

Materials and methods

Patients

In this prospective cohort study, a total of 75 patients who underwent ESD for early-stage EC at Department of Gastroenterology, Renmin Hospital, Hubei University of Medicine from Jan 2016 to May 2017 were consecutively enrolled. The inclusion criteria were: a) Diagnosed as EC by clinical, imaging and pathological findings; b) Age ≥ 18 years old; c) Underwent ESD operation and tumor lesion could be completely removed; d) With a circumferential range above 3/4, longitudinal length above 3 cm and lesion depth no more than M2; e) Could be followed up regularly. Patients were excluded if they: a) had a history of esophagectomy or radiation therapy, b) complicated with coagulative dysfunction, severe organ failure, malignant hematological disease or other solid tumors. Meanwhile, pregnant or lactating women were also excluded from this study.

Ethics statement

The present study protocol was approved by the Ethics Committee of Renmin Hospital, Hubei University of Medicine and complied with the Declaration of Helsinki requirements. Written informed consents were obtained from all patients before enrollment.

Information collection

After enrolled in this study, EC patients' baseline characteristics were collected including age, gender, complications (hypertension, diabetes mellitus and dyslipidemia), family history of EC, lesion location, tissue depth, longitudinal length and circumferential range.

Treatment

This was a prospective cohort study without any interventions, and all patients received PGA sheet coated stent placement or only stent placement to prevent esophageal stricture post ESD operation according to disease conditions and personal willingness. In terms of treatment choices of patients, those patients who received PGA sheet coated stent placement were allocated into PGA+Stent group, and patients who received only stent placement were allocated into Stent group.

ESD procedure

ESD was performed as follows: (1) The extent of the lesion was identified by iodine staining under the endoscope (GIF Q240; Olympus Co.); (2) Several marker dots were placed approximately 5-10 mm from the margin of the lesion by argon plasma coagulation (APC); (3) The lesion was lifted by injecting solution (100 mL saline +5 mL 0.2% indigo carmine +1 mg epinephrine) into the submucosal layer, and then the mucosa was incised outside the marker dots using the insulated-tip (IT) knife (KD-611L; Olympus) or HookKnife (KD-620LR; Olympus); (4) The submucosal tissue underneath the lesion was then carefully dissected using the IT or HookKnife; (5) Exposed small vessels were treated by a hemostatic procedure.

Stent wrapped with PGA sheet

According to the circumference and length of the artificial ulcer after ESD, the size of stent (18 mm of diameter, Boston Scientific Corporation, MA, metallic radiopaque material, covered with a translucent silicone polymer) and PGA sheet (Dexon TM Mesh, Syneture, USA) was selected. Then stent was covered with PGA sheet and mounted into the delivery device, and released at the appropriate position through the guidewire under endoscope guidance.

Stent placement and remove

The stent placement procedure was as follows: (1) Length of artificial ulcer was confirmed under endoscope, and markers were placed at

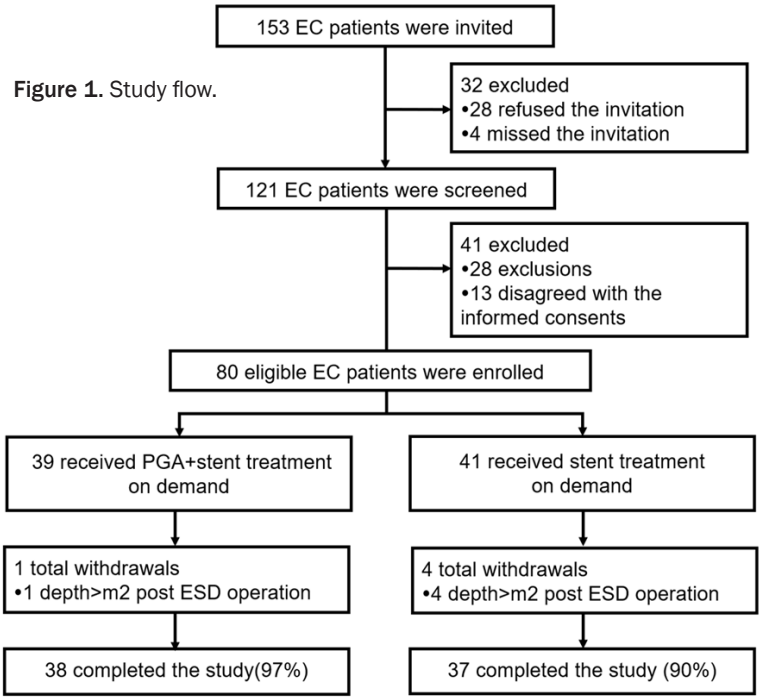

Figure 1. Study flow.

the body surface of the proximal and distal end of the artificial ulcer. (2) The size of stent was selected based on the length of artificial ulcer. (3) A 260-cm-long exchange guidewire was inserted into the stomach. (4) Along with the guidewire, the stent was installed in the propeller. (5) After the propeller was pushed to the appropriate position between markers, the mantle annular tube was retracted, after which the stent would automatically expand. (6) After stent expansion, X-ray was used to examine the stent position, meanwhile, the stent position was recorded.

When removing stent, a protractor was used to loosen the stent from its surroundings and was then connected to the stent orifice. The stent orifice shrank when we contracted the protractor, and then the stent was removed. Furthermore, for patients who received PGA sheet coated stent placement, stent was removed by endoscopy at 4th week after ESD due to the degradation of PGA, while in those patients who only received stent placement, stent was removed at 8th weeks after ESD.

Definition of esophageal stricture

Esophageal stricture was defined as the presence of a stricture of the esophageal lumen that had progressed to the point where a 9.8 mm diameter upper gastrointestinal endoscope could not pass through it.

Endoscopic balloon dilation (EBD)

In patients who developed an esophageal stricture, the first session of EBD was performed using an esophageal balloon dilation catheter (CRE Fixed Wire 12 mm/15 mm/18 mm; Boston Scientific Japan Co., Tokyo, Japan) immediately after the stricture had been endoscopically confirmed. EBD was repeated as required until the stenosis of the esophageal lumen widened and it was possible to pass the endoscope through the esophageal lumen.

Follow-up and endpoints

Endoscopic examination was performed to monitor the position of esophageal stent every 2 weeks after ESD, if a stent moved more than 2 cm, the position of stent was adjusted. After stent removed, patients were followed up every 4 weeks through clinic visits or phone call and asked whether dysphagia or other symptoms occurred, if the patient began to experience symptoms of dysphagia, endoscopy was performed. The primary endpoint of this study was the incidence of postoperative stricture after esophageal ESD and the secondary endpoints including the days to esophageal stricture, location, length and diameter of esophageal stricture and balloon dilatation times for the esophageal stricture.

Statistics

Statistical analysis was performed by SPSS 21.0 software (IBM, USA) and Graphpad prism 6 software (GraphPad Software Inc, USA). Normal distributed data were presented as mean ± standard deviation; count data were presented as count (percentage); skewed distributed data were presented as median (1/4-3/4 quartile). Comparison was determined by t test, Chi-square test or Wilcoxon rank sum test. Factors affecting esophageal stricture occur-

Table 1. Baseline characteristics of EC patients

Parameter	PGA+Stent group (N = 38)	Stent group (N = 37)	*P* value
Patient characteristics			
Age (years)	64.53±9.76	60.97±9.86	0.121
Gender			0.414
Male (n/%)	27 (71.1)	23 (62.2)	
Female (n/%)	11 (28.9)	14 (37.8)	
Complications			
Hypertension (n/%)	15 (39.5)	10 (27.0)	0.253
Diabetes mellitus (n/%)	3 (7.9)	4 (10.8)	0.664
Dyslipidemia (n/%)	10 (26.3)	7 (18.9)	0.444
Family history of EC (n/%)	2 (5.3)	2 (5.4)	0.978
Lesion characteristics			
Location			0.566
Upper third (n/%)	1 (2.6)	1 (2.7)	
Middle third (n/%)	11 (28.9)	15 (40.5)	
Lower third (n/%)	26 (68.5)	21 (56.8)	
Tissue depth			0.414
M1 (n/%)	27 (71.1)	23 (62.2)	
M2 (n/%)	11 (28.9)	14 (37.8)	
Longitudinal length (mm)	48.0 (41.0-60.0)	55.0 (43.5-71.0)	0.329
Longitudinal length ≥ 50 mm (n/%)	17 (44.7)	19 (51.4)	0.566
Circumferential range			0.562
3/4 (n/%)	15 (39.5)	12 (32.5)	
4/5 (n/%)	10 (26.3)	14 (37.8)	
1/1 (n/%)	13 (34.2)	11 (29.7)	

Data was presented as mean ± standard deviation, count (percentage) or median (1/4-3/4 quartile). Comparison was determined by t test, Chi-square test or Wilcoxon rank sum test. $P < 0.05$ was considered significant. PGA, polyglycolic acid; EC, esophagus cancer.

rence were determined by univariate logistic regression analysis. All the variables that might affect esophageal stricture occurrence were put into the multivariate regression, and we did not select variables artificially. Multivariate logistic regression analysis was used to assess independent predictive factors affecting esophageal stricture occurrence. 95% CI in wide range suggested that there might be some errors in the regression result of the variable due to the insufficient sample size or relatively less number of events. *P* value < 0.05 was considered significant.

Results

Study flow

Totally 153 EC patients were invited in this study, while 32 patients were excluded, including 28 patients who refused the invitation and 4 patients who missed the invitation (**Figure 1**). In the remaining 121 EC patients who were screened for the study, 41 patients were excluded, among which 28 patients failed to meet the inclusions or in the exclusions and 13 patients disagreed with the informed consents. Thus, 80 eligible EC patients were enrolled in the subsequent study. According to patients' disease conditions and willingness, 39 patients received PGA plus stent treatment, and they were divided into PGA+stent group, while other 41 patients received stent treatment, and they were categorized as stent group. In the PGA+stent group, 1 patient withdrew from the study due to lesion depth > M2 observed in ESD operation. As for stent group, 4 patients withdrew from the study on account of the lesion depth > M2 in ESD operation. Finally, totally 75 patients from PGA+stent group (N = 38) and stent group (N = 37) completed the study and were analyzed in this present study.

Baseline characteristics

Mean ages of patients in PGA+stent group and stent group were 64.53±9.76 years and 60.97±9.86 years respectively (**Table 1**). There were 27 males (71.1%) and 11 females (28.9%) in PGA+stent group, but 23 males (62.2%) and 14 females (37.8%) in stent group. No difference was observed in age (*P* = 0.121), gender (*P* = 0.414), complications (including hypertension (*P* = 0.253), diabetes mellitus (*P* = 0.664) as well as dyslipidemia (*P* = 0.444)), and family history of EC (*P* = 0.978) between the PGA+stent and stent groups. Regarding

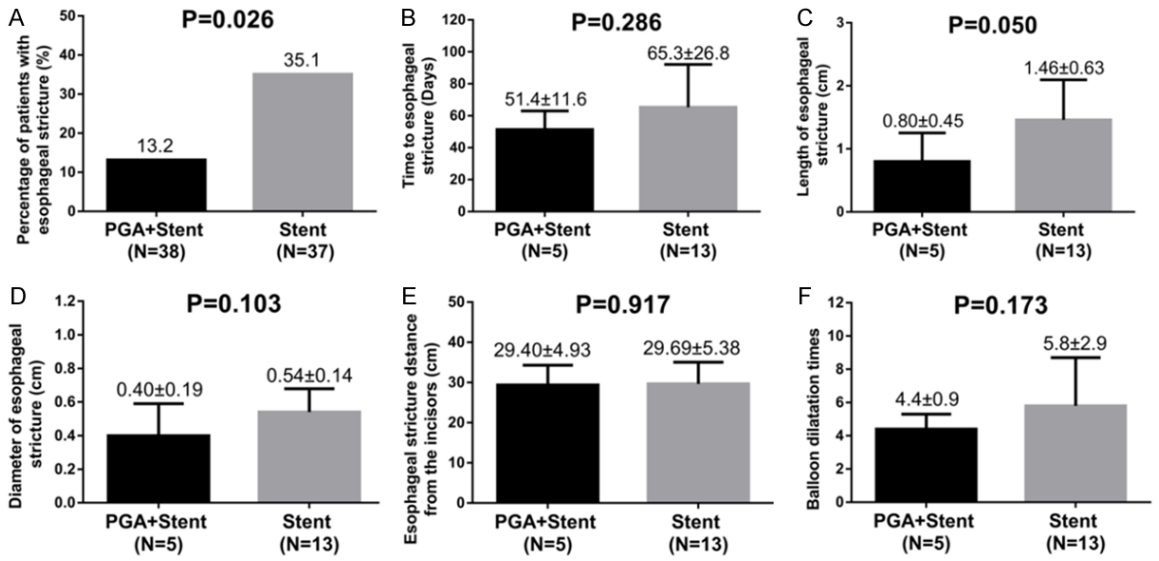

Figure 2. Comparison of esophageal stricture features in PGA+Stent and stent groups. Percentage of patients with esophageal stricture in PGA+stent group was lower than that in stent group (A). Length of esophageal stricture in PGA+stent group was numerically shorter compared with stent group (C). No difference of time to esophageal stricture (B), diameter of esophageal stricture (D), esophageal stricture distance from the incisions (E) and balloon dilatation times (F) was found between PGA+stent group and stent group. Comparison of esophageal stricture occurrence between PGA+stent group and stent group was determined by Chi-square test. Comparison of time to esophageal stricture, length of esophageal stricture, diameter of esophageal stricture, esophageal stricture distance from the incisions and balloon dilatation times between PGA+stent group and stent group was determined by t test. *P* value < 0.05 was considered significant.

lesion characteristics, there was also no difference between groups as well (All $P > 0.05$). Number of cases with lesion location at upper third, middle third and lower third in PGA+stent group were 1 (2.6%), 11 (28.9%) and 26 (68.5%) respectively, while the numbers in stent group were 1 (2.7%), 15 (40.5%) and 21 (56.8%) respectively. As to tissue depth, the numbers of cases with M1 in PGA+stent group and stent group were 27 (71.1%) and 23 (62.2%), and the numbers of cases with M2 in the two groups were 11 (28.9%) and 14 (37.8%) respectively. Median value of longitudinal length of PGA+stent group and stent group were 48.0 (41.0-60.0) mm and 55.0 (43.5-71.0) mm respectively, and the numbers of patients with longitudinal length ≥ 50 mm in the two groups were 17 (44.7) and 19 (51.4) respectively. The other detailed information of patients in PGA+stent group and stent group was listed in **Table 1**.

PGA+stent was more effective in preventing post-ESD esophageal stricture

As exhibited in **Figure 2A**, the percentage of patients in PGA+stent group developed esophageal stricture was 13.2% (n = 5), while the percentage in stent group 35.1% (n = 13), thus PGA+stent was more effective in preventing stricture compared to stent alone ($P = 0.026$). As to the esophageal stricture features, length of esophageal stricture in PGA+stent group was numerically shorter than that in stent group (**Figure 2C**, $P = 0.050$). While no difference in time to esophageal stricture (**Figure 2B**, $P = 0.286$), diameter of esophageal stricture (**Figure 2D**, $P = 0.103$), esophageal stricture distance from the incisions (**Figure 2E**, $P = 0.917$) or balloon dilatation time (**Figure 2F**, $P = 0.173$) was found between PGA+stent group and stent group.

No difference of tumor lesion features between stricture cases in PGA+stent group and stricture cases in stent group

In the comparison of tumor lesion features in patients occurred stricture, no difference of location ($P = 0.729$), tissue depth ($P = 0.896$), longitudinal length ($P = 0.924$) or circumferential range ($P = 0.852$) between PGA+stent group and stent group was observed (**Table 2**). Numbers of patients with tumor lesion at upper

Table 2. Tumor lesion features in patients occurred esophageal stricture

Parameter	PGA+Stent group	Stent group	*P* value
Esophageal stricture (n/%)	5/38 (13.2)	13/37 (35.1)	0.026
Location			0.729
Upper third (n/%)	1/5 (20.0)	1/13 (7.7)	
Middle third (n/%)	2/5 (40.0)	5/13 (38.5)	
Lower third (n/%)	2/5 (40.0)	7/13 (53.8)	
Tissue depth			0.896
M1 (n/%)	2/5 (40.0)	3/13 (23.1)	
M2 (n/%)	3/5 (60.0)	10/13 (76.9)	
Longitudinal length (mm)	60.0 (54.0-94.0)	65.0 (51.0-79.0)	0.924
Circumferential range			0.852
3/4 (n/%)	0/5 (0.0)	0/13 (0.0)	
4/5 (n/%)	1/5 (20.0)	5/13 (38.5)	
1/1 (n/%)	4/5 (80.0)	8/13 (61.5)	

Data was presented as count (percentage) or median (1/4-3/4 quartile). Comparison was determined by Chi-square test or Wilcoxon rank sum test. $P < 0.05$ was considered significant. PGA, polyglycolic acid.

third, middle third and lower third in PGA+stent group were 1 (20.0%), 2 (40.0%) and 2 (40.0%) respectively, while in stent group were 1 (7.7%), 5 (38.5%) and 7 (53.8%) respectively. As to tissue depth, the numbers of patients with M1 and M2 were 2 (40.0%) and 3 (60.0%) in PGA+stent group, but 3 (23.1%) and 10 (76.9%) respectively in stent group. Median value of longitudinal lengths in PGA+stent group and stent group were 60.0 (54.0-94.0) mm and 65.0 (51.0-79.0) mm respectively. In addition, the numbers of patients with 3/4, 4/5 and 1/1 circumferential range in PGA+stent group were 0 (0.0%), 1 (20.0%) and 4 (80.0%) respectively, but in stent group were 0 (0.0%), 5 (38.5%) and 8 (61.5%) respectively.

PGA+stent predicted less esophageal stricture occurrence

Analysis of univariate logistic regression revealed that PAG + stent (vs. stent, $P = 0.031$) was associated with decreased occurrence of esophageal stricture (**Table 3**). Whereas, tissue depth M2 (vs. M1, $P < 0.001$), longitudinal length ≥ 50 mm ($P = 0.002$) and circumferential range = 1/1 (vs. others, $P = 0.001$) were correlated with elevated esophageal stricture occurrence. In subsequent analysis of multivariate logistic regression, PGA+stent was verified to be an independent factor for predicting reduced esophageal stricture occurrence ($P = 0.021$), while tissue depth M2 (vs. M1, $P = 0.014$), longitudinal length ≥ 50 mm ($P = 0.034$) and circumferential range = 1/1 (vs. others, $P = 0.043$) were independent risk factors predicting occurrence of esophageal stricture.

Discussion

In this study, we observed that occurrence of esophageal stricture in PGA+stent group was decreased compared to stent group, and among these patients with esophageal stricture, length of esophageal stricture in PGA+stent was numerically shorter than that in stent group. In addition, multivariate logistic regression model revealed that PGA+stent compared to stent alone was an independent factor predicting absence of esophageal stricture.

ESD, as an effective therapeutic operation in high-grade dysplasia and early esophageal cancer, has obtained acceptance in the last decade [15, 16]. Whereas, during the process of wound healing after ESD procedure, hyperplasia, scar contracture or deep ulcer usually occurs in the residual mucosal wound, thereby leading to esophageal stricture [17]. In order to solve this problem, various measures have been applied, such as endoscopic balloon dilation (EBD), intralesional/oral steroid therapy and transplantation of autologous cell sheets [18, 19]. Among these, stent placement is the common used prophylactic measure with following advantages: firstly, it provides sustained dilatation effects to the strictured segment; secondly, it could be removed easily if the stricture is alleviated or complications happen [20]. However, long-term effect of stent is not always favorable due to the relatively higher incidence of complications including chest pain, hyperplasia of granulation tissue, and stent displacement [21, 22]. As for PGA, which is able to degrade into nontoxic products in physiological conditions, has been tentatively applied in patients underwent ESD with some unique characteristics: (1) its fibrillar reticulation offers a matrix, which makes cells be prone to crawl-

Table 3. Logistic analysis of factors affecting esophageal stricture occurrence

Parameters	Univariate logistic regression				Multivariate logistic regression			
	P value	OR	95% CI		*P* value	OR	95% CI	
			Lower	Higher			Lower	Higher
PGA+Stent (vs. Stent)	0.031	0.280	0.088	0.890	0.021	0.103	0.015	0.711
Age ≥ 60 years	0.261	0.541	0.185	1.579	0.938	0.936	0.175	5.007
Gender (Male)	0.567	0.725	0.241	2.179	0.803	0.800	0.140	4.585
Hypertension	0.255	1.882	0.633	5.594	0.849	0.814	0.098	6.729
Diabetes mellitus	0.767	1.300	0.230	7.354	0.726	0.518	0.013	20.457
Dyslipidemia	0.221	2.091	0.642	6.807	0.439	2.303	0.279	19.020
Family history of EC	0.999	0.000	0.000	-	0.999	0.000	0.000	-
Location-lower third (vs. others)	0.207	0.500	0.171	1.466	0.247	0.361	0.064	2.027
Tissue depth M2 (vs. M1)	< 0.001	9.750	2.901	32.766	0.014	8.295	1.524	45.146
Longitudinal length ≥ 50 mm	0.002	8.571	2.219	33.109	0.034	7.252	1.162	45.258
Circumferential range = 1/1 (vs. others)	0.001	7.500	2.331	24.133	0.043	5.934	1.055	33.389

Data was presented as *P* value, OR (odds ratio) and 95% CI. Factors affecting esophageal stricture occurrence were determined by univariate and multivariate logistic regression analysis. Location was scored as 1-lower third, 0-upper or middle third. Circumferential range was scored as 1-1/1, 0-3/4 or 4/5. Tissue depth was scored as 1-M2, 0-M1. *P* Value < 0.05 was considered significant. PGA, polyglycolic acid; EC, esophagus cancer.

ing on it, thereby preventing scar formation and decreasing risk of esophageal stricture; (2) it is able to carry cells or drugs, which contributes to repair and healing of wound [23-25].

Regarding the clinical application of stent, several studies have confirmed the efficacy of stent in EC patients after ESD [26-29]. A randomized controlled study reveals that stent decreases the proportion of post-ESD stricture compared with controls (18.2% vs. 72.7%), suggesting the good efficacy of stent in preventing esophageal stricture after ESD [30]. As to PGA, there are a few studies investigate the application of PGA in prevention of esophageal stricture [3, 23, 31]. For example, Kim Yeong Jin et al. disclose a case receiving PGA sheet procedure to prevent post-ESD esophageal stricture, while esophageal stricture was observed at 7 weeks after ESD with 1-2 cm in the focal stricture size, while only one time of EBD is performed to relieve the dysphagia [31]. Sakaguchi et al. use PGA sheets and fibrin glue to prevent esophageal stricture in 8 patients who have underwent ESD. Incidence of esophageal stricture in their study is 37.5% with a mean time to stricture occurrence of 28±7 days, which is comparable to oral/focal administration of corticosteroids injection [23]. The combination of PGA sheet and fibrin glue has been used in another study, which exhibits a post-ESD stricture rate of 9.1% (3/33) at 6 weeks after operation, while most PGA sheets have detached from the artificial ulcer at 1 week [3]. All these studies display certain efficacy of only stent or PGA in preventing esophageal stricture, while either stent or PGA has its drawbacks such as stent displacement and undesired detachment from target lesions, which may limit its application [19, 21, 22, 31]. Hence, we combined PGA with stent to evaluate the efficacy of PGA+stent therapy in prevention of post-ESD esophageal stricture, and we found that PGA plus stent decreased esophageal stricture occurrence compared with stent group, and numerally reduced the severity of esophageal stricture. The possible reasons were as follows. Firstly, stent offered a support to hold PGA sheet on the wound surface, which prevented the detachment of PGA sheet, thus the adequate time to contact with wound surface did help the prevention of esophageal stricture. Secondly, the combination of PGA and stent reduced the risk of stent migration compared with stent placement alone, and thereby brought a better prophylactic effect. Thirdly, the fibrillar reticulation of PGA provided a suitable matrix environment for cells growth, thus abnormal esophageal conditions such as hyperplasia and scar lessened. Interestingly, there is another study investigates the combination of PGA and stent in preventing esophageal stricture, which has been published before our study [32]. However, the analyses of esophageal stricture features in PGA+Stent and stent groups are not included in the previous study,

and we found that length of esophageal stricture in PGA+stent group was numerically shorter compared with stent group.

Regarding predictive effect, we found that PGA plus stent was an independent predictive factor for reduced risk of esophageal stricture compared with stent alone, which might result from the followings: on the one hand, the PGA sheet with plenty of fibrillar reticulations carried cells, which was favorable for cell growth during process of wound healing and decreased esophageal stricture risks; on the other hand, the addition of PGA contributed to fractional force between stent and wound surface, and it decreases the probabilities of stent displacement and offering sustained dilatation effects to the target position, meanwhile, stent also supported PGA on the surface, thus improved cell growth and prevention of esophageal stricture.

Our study still had some limitations: (1) sample size (N = 75) was relatively small, thus the statistical power was relatively low; (2) this study was a single-center study, which lacked wide representation. Thus, multi-center studies with more early-stage EC patients is required to evaluate the preventive effect of PGA plus stent on esophageal stricture.

In summary, PGA plus stent therapy achieves lower occurrence of post-ESD esophageal stricture as well as numerically lighter esophageal stricture severity compared to stent therapy alone in early-stage EC patients.

Disclosure of conflict of interest

None.

Address correspondence to: Junhua Hu and Guangxin Lu, Department of Gastroenterology, Renmin Hospital, Hubei University of Medicine, 39 Chaoyang Road, Shiyan 442000, Hubei, P.R. China. Tel: +86-13972455468; E-mail: hujunhua08@163.com (JHH); Tel: +86-13986916522; E-mail: lu_guangxin@outlook.com (GXL)

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