

World Journal of *Clinical Cases*

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OPINION REVIEW

- 3377 Novel computerized psychometric tests as primary screening tools for the diagnosis of minimal hepatic encephalopathy
Luo M, Mu R, Liu JF, Bai FH

REVIEW

- 3390 Management of cancer patients during COVID-19 pandemic at developing countries
González-Montero J, Valenzuela G, Ahumada M, Barajas O, Villanueva L

MINIREVIEWS

- 3405 Liver in the limelight in the corona (COVID-19) time
Chela HK, Pasha SB, Basar O, Daglilar E, Tahan V
- 3411 Steroid-responsive pancreatitis
Pelaez-Luna M, Soriano-Rios A, Lira-Treviño AC, Uscanga-Domínguez L

ORIGINAL ARTICLE**Clinical and Translational Research**

- 3431 Application of molybdenum target X-ray photography in imaging analysis of caudal intervertebral disc degeneration in rats
Su QH, Zhang Y, Shen B, Li YC, Tan J
- 3440 Accuracy study of a binocular-stereo-vision-based navigation robot for minimally invasive interventional procedures
Wang R, Han Y, Luo MZ, Wang NK, Sun WW, Wang SC, Zhang HD, Lu LJ

Retrospective Study

- 3450 Value of virtual bronchoscopic navigation and transbronchial ultrasound-guided sheath-guided exploration in diagnosis of peripheral lung cancer
Liu Y, Wang F, Zhang QC, Tong ZH
- 3458 Significance of serum fibroblast growth factor-23 and miR-208b in pathogenesis of atrial fibrillation and their relationship with prognosis
Chen JM, Zhong YT, Tu C, Lan J
- 3465 Home quarantine compliance is low in children with fever during COVID-19 epidemic
Lou Q, Su DQ, Wang SQ, Gao E, Li LQ, Zhuo ZQ

- 3474 Combination of endoscopic submucosal dissection and laparoscopic sentinel lymph node dissection in early mucinous gastric cancer: Role of lymph node metastasis

Li H, Zhao LL, Zhang XC, Liu DX, Wang GY, Huo ZB, Chen SB

- 3483 Factors affecting failed trial of labor and countermeasures: A retrospective analysis

Wang JG, Sun JL, Shen J

- 3493 Value of miR-1271 and glypican-3 in evaluating the prognosis of patients with hepatocellular carcinoma after transcatheter arterial chemoembolization

Guo Z, Wang J, Li L, Liu R, Fang J, Tie B

Observational Study

- 3503 Follow-up study on symptom distress in esophageal cancer patients undergoing repeated dilation

Liu L, Liu QW, Wu XD, Liu SY, Cao HJ, Hong YT, Qin HY

- 3515 Long-term medical treatment of patients with severe burns at exposed sites

Du Y, Lv GZ, Yu S, Wang D, Tan Q

CASE REPORT

- 3527 Laparoscopic management of a giant mucinous benign ovarian mass weighing 10150 grams: A case report

Sanna E, Madeddu C, Melis L, Nemolato S, Macciò A

- 3534 Concurrent hepatocellular carcinoma metastasis to stomach, colon, and brain: A case report

Kim R, Song J, Kim SB

- 3542 Disseminated osteomyelitis after urinary tract infection in immunocompetent adult: A case report

Kim YJ, Lee JH

- 3548 Pelvic lipomatosis and renal transplantation: A case report

Zhao J, Fu YX, Feng G, Mo CB

- 3553 Intestinal obstruction in pregnancy with reverse rotation of the midgut: A case report

Zhao XY, Wang X, Li CQ, Zhang Q, He AQ, Liu G

- 3560 Clinical laboratory investigation of a patient with an extremely high D-dimer level: A case report

Sun HX, Ge H, Xu ZQ, Sheng HM

- 3567 Recovery from a biliary stricture of a common bile duct ligature injury: A case report

Fan Z, Pan JY, Zhang YW

- 3573 Spontaneous pneumomediastinum in an elderly COVID-19 patient: A case report

Kong N, Gao C, Xu MS, Xie YL, Zhou CY

- 3578 Acute generalized exanthematous pustulosis with airway mucosa involvement: A case report

Li LL, Lu YQ, Li T

- 3583** Multifocal neuroendocrine cell hyperplasia accompanied by tumorlet formation and pulmonary sclerosing pneumocytoma: A case report
Han XY, Wang YY, Wei HQ, Yang GZ, Wang J, Jia YZ, Ao WQ
- 3591** Giant benign phyllodes breast tumour with pulmonary nodule mimicking malignancy: A case report
Zhang T, Feng L, Lian J, Ren WL
- 3601** Spontaneous multivessel coronary artery spasm diagnosed with intravascular ultrasound imaging: A case report
Wu HY, Cao YW, Chang FJ, Liang L
- 3608** Delayed perforation after endoscopic resection of a colonic laterally spreading tumor: A case report and literature review
Zhou GYJ, Hu JL, Wang S, Ge N, Liu X, Wang GX, Sun SY, Guo JT
- 3616** First branchial cleft cyst accompanied by external auditory canal atresia and middle ear malformation: A case report
Zhang CL, Li CL, Chen HQ, Sun Q, Liu ZH

ABOUT COVER

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Observational Study

Follow-up study on symptom distress in esophageal cancer patients undergoing repeated dilation

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Abstract

BACKGROUND

Repeated endoscopic probe dilatation is the most preferred treatment for esophageal stenosis which may cause high levels of symptom distress in the patient's home rehabilitation stage.

AIM

To explore the changes in the symptom distress level and its correlation with the dilation effect in patients with esophageal carcinoma undergoing repeated dilations for lumen stenosis.

METHODS

The difference (R2-R1) between the diameter of the esophageal stenosis opening

approval for this study (GYX2018-010).

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(R1) of the patients before dilation (R1) and after dilation (R2) was calculated to describe the extent and expansion of the esophageal stenosis before and after dilation. The M.D. Anderson Symptom Inventory was used to describe the symptom distress level of patients with dilation intermittence during their stay at home and to explore the correlation between the dilation effect and symptom distress level.

RESULTS

The diameter of the esophagus (R1) increased before each dilation in patients undergoing esophageal dilation ($P < 0.05$). The diameter (R2) increased after dilation ($P < 0.05$); the dilation effect (R2-R1) decreased with the number of dilations ($P < 0.05$). The total symptom distress score significantly increased with the number of dilations ($P < 0.05$). The symptom distress scores of the patients were negatively correlated ($P < 0.05$) with the previous dilation effect (R2-R1) and the esophageal diameter (R2) after the previous dilation. After the 1st to 4th dilations, the patient's symptom distress score was negatively correlated with the esophageal diameter (R12) before the next dilation, while there was no significant correlation ($P > 0.05$) with the other dilations.

CONCLUSION

In patients who have undergone repeated dilations, better effect stands for lower symptom distress level and the increase in symptom distress has a prompt effect on the severity of the next occurrence of restenosis.

Key words: Esophageal carcinoma; Dilation of esophageal stenosis; Symptom distress; Dilation effect; Lumen stenosis; Repeated dilation

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Core tip: Esophageal carcinoma ranks 6th in terms of the associated mortality rate and the incidence of complications after standardized comprehensive treatment of esophageal carcinoma is between 12.3% and 38%. Repeated endoscopic probe dilatation is the most preferred treatment for esophageal stenosis, which may cause high levels of symptom distress in the patient's home rehabilitation stage. This study explored the changes in the symptom distress level and its correlation with the dilation effect in patients with esophageal carcinoma undergoing repeated dilations for lumen stenosis. Based on these data, we can find the changes in the symptom distress level and its correlation with the dilation effect, which can contribute to patients' symptoms management.

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INTRODUCTION

Esophageal carcinoma ranks 8th worldwide among other cancers in terms of incidence and 6th in terms of the associated mortality rate. The incidence rate of esophageal carcinoma in China is increasing, showing obvious regional differences^[1-4]. The incidence of complications after standardized comprehensive treatment of esophageal carcinoma is between 12.3% and 38%, which is significantly higher than that of other digestive tract cancers^[3-6]. Esophageal stenosis is one of the most common complications due to the particularity of the esophageal wall anatomy^[7,8]. The causes of esophageal stricture include scars from anastomotic stoma, rigid mucosa after radiotherapy, and hyperplasia after endoscopic annular mucosal dissection^[9]. According to the severity, esophageal stenosis can be classified as severe stenosis (diameter [R] = 0.10-0.39 cm), moderate stenosis (R = 0.40-0.69 cm), or mild stenosis (R = 0.70-1.00 cm). Patients often feel that they are unable to eat when the esophagus is mildly to moderately narrow^[10].

Surgery, stent implantation, and endoscopic dilation are common methods for the treatment of esophageal stenosis. However, esophageal stenosis can easily relapse and requires repeated treatments. Repeated surgical operations for esophageal stenosis are traumatic and are generally rarely accepted by patients. The time required for stent placement is short, the cost is high, and restenosis can easily occur. Therefore, repeated endoscopic probe dilatation is still the most preferred treatment for esophageal stenosis^[11]. Dilation for esophageal stenosis relies on the mechanical destruction of scar tissue by the dilation probe to dilate the stenosis. Patients with esophageal stenosis usually undergo dilation once every 2-4 wk. By comparing the diameter of the esophagus before and after dilation and food intake, we can determine whether the dilation is effective. If the dilation is effective and the esophagus is no longer narrow, complete remission is considered to have occurred^[12]. Studies have shown that to achieve complete remission, approximately 41% of patients need dilations three times, approximately 20% need dilations three to five times, approximately 23% need dilations 5-10 times, and 12% need dilations more than 10 times^[13]. During the dilation process, the endoscope and the dilation probe repeatedly enter and exit the esophagus entrance. Tearing and bleeding of the pharynx, pyriform fossa, and esophagus mucosa to varying degrees are inevitable, and even perforation occurs^[14]. In addition, endoscopists generally do not recommend sedation or anesthesia for dilation so that they can better observe the presence or absence of complications, such as perforation, through the patient's response during the operation. Patients usually feel severe pain and suffer great physical and mental pain during the operation process. Short-term treatment often causes high levels of symptom distress in the patient's home rehabilitation stage. Symptom distress refers to "the degree of distress caused by specific symptoms experienced by the patient" and can also be defined as "physical or mental pain or suffering caused by the occurrence of symptoms and/or emotional changes in the patient"^[15]. Among cancer patients, an average of 35.1% have symptoms of varying degrees^[16]. There are many research studies on symptom distress in tumor patients at home and abroad, but for esophageal carcinoma patients who need repeated esophageal dilation, the symptom distress levels and changes have not been mentioned in any research studies.

This study aimed to investigate the changes in the esophageal diameter and symptom distress level in patients during the interval of dilation as the number of dilations increased to explore the dilation effect and its correlation with symptom distress level. The results of this study will be helpful for clinical nursing staff to understand the impact of repeated invasive diagnoses and treatments in patients during the home rehabilitation period and to further understand the problems and needs of tumor patients in the disease treatment and rehabilitation stages. Moreover, the results from the study will provide a basis for the design and implementation of symptom management programs, help relieve pain caused by symptom distress, and help improve the quality of life of patients.

MATERIALS AND METHODS

General information

In this study, a convenient sampling method was used to identify patients who were diagnosed with esophageal carcinoma by a pathological examination from January 1, 2018 to October 31, 2019 and suffered from esophageal stenosis after operation, radiotherapy and chemotherapy, comprehensive treatment, or endoscopic resection. After an evaluation was performed by endoscopic physicians, patients underwent endoscopic dilation for esophageal stenosis at the Sun Yat-sen University Cancer Center. The inclusion criteria were as follows: Aged 18-75 years, completed primary school or a higher level of education, diagnosed with the disease condition, provided contact information, and agreed to participate in follow-ups. The exclusion criteria were as follows: History of mental illness or dyslexia, distant metastasis, history of other malignant tumors caused by esophageal carcinoma accidents, and serious complications. If esophageal stenosis was found during operation and the diameter was less than < 0.1 cm, it was difficult to pass the guide wire. If a patient could not tolerate the operation, did not participate in the follow-up, or exhibited recurrence, metastasis, complications of other tumors, or changes in other treatment methods during the follow-up period, the patient was excluded. A total of 105 patients were included in this study, including 64 males and 41 females, aged 43-72 years, with an average age of 51.48 ± 4.15 years. Sixteen (15.24%) patients suffered from esophageal stenosis after surgical treatment, 24 (22.86%) suffered from stenosis after radiotherapy

and chemotherapy, 54 (51.43%) suffered from stenosis after comprehensive treatment, 8 (7.62%) suffered from stenosis after endoscopic mucosal stripping, and 3 (2.86%) suffered from other conditions (immunotherapy, *etc.*). In this study, there were no severe complications, such as perforation during expansion.

Equipment and apparatus

In this study, endoscopic probe dilatation for esophageal stenosis was performed as follows: An OLYMPUS GIF-XP260N ultrafine transnasal gastroscope was used according to the gastroscope examination routine, the gastroscope was inserted through the oral cavity under the awake state, the esophageal stenosis was observed and recorded, and a silica gel probe dilator was selected according to the stenosis severity. The sizes of the dilators included 0.5 cm, 0.7 cm, 0.9 cm, 1.1 cm, 1.28 cm, 1.4 cm, 1.5 cm, and 1.6 cm. First, the metal guide wire was introduced from the working channel of the gastroscope and passed through the narrow part. The guide wire was retained, and the ultrafine gastroscope was pulled out. The dilation was slowly inserted along the guide wire for mechanical dilation for 2 min at each dilation pass. After less than three-degree dilations, the dilation probe and the guide wire were withdrawn together, and then the gastroscope was inserted again to assess the dilation effect of the narrow part. Patients with esophageal stenosis underwent dilation every 3 wk until complete remission.

Research tools

Endoscopic dilation of patient file: We designed an "Endoscopic Dilation of Patient File" for each esophageal cancer patient after surgery, radiotherapy and chemotherapy, or comprehensive treatment; the file included demographic characteristics, disease treatment characteristics, esophageal stenosis information, including the diameter of esophageal stenosis opening (R1) before each dilatation, registration of the operation process, and the diameter (R2) of the esophageal stenosis opening of the patient after expansion. Finally, (R2-R1) was calculated to describe the current expansion effect.

M.D. Anderson Symptom Inventory: The M.D. Anderson Symptom Inventory (MDASI) was first developed by American Scholar Cleeland in 2000^[17]. The original version includes two parts, the symptom subscale and the distress subscale. There are 13 items in the MDASI. The physical and psychological symptoms in the past 24 h are evaluated. There are six items in the distress subscale that are used to evaluate the effect of the symptoms listed in the symptom subscale, and the items concern self-care activities, emotions, work or housework, interpersonal relationships with others, walking, and enjoying daily life. Each item was scored on an 11-point scale from 0 (no points at all) to 10 (the highest level of severity). Since an esophageal carcinoma-specific symptom distress inventory has not yet been developed, this study supplemented the Chinese version of the MDASI with the specific symptoms of esophageal stenosis patients after receiving treatment, namely, dysphagia, reflux, choking cough, weight loss, and hoarseness. Twenty patients were selected for the preinvestigation to assess internal consistency. After testing, the Cronbach's α coefficient of the complete inventory, the first part of the original inventory, and the summed items were 0.837, 0.799, and 0.734, respectively. According to the evaluation of five experts from the Thoracic Department, Department of Endoscopy, and School of Nursing of Sun Yat-sen University Cancer Center, the supplementary items have good content validity.

During the interval between two dilations, *i.e.*, the 10th day after each dilation, the MDASI was administered to evaluate and describe the symptom distress level of patients with different dilations, and the changes were described considering the time effect. Then, we analyzed the correlation between the symptom distress score and esophageal diameter (R2) after the previous dilation, esophageal diameter (R1) before the next dilation, and the previous dilation effect (R2-R1).

Data collection

With the consent of the relevant departments of the hospital where the research was being carried out, the data were collected at the endoscopy center and thoracic endoscopy room of Sun Yat-sen University Cancer Center.

Esophageal carcinoma patients who were diagnosed with esophageal stenosis by endoscopic physicians and were planning to undergo dilation of esophageal stenosis repeatedly were selected. The patients received dilation for esophageal stenosis once every 3 wk. The researchers conducted a longitudinal follow-up investigation from the beginning of the patient's first dilation operation until the patient achieved a marked

effect and terminated treatment. The patients who refused to participate in the follow-up or could not participate in the follow-up for other reasons, such as a change in the treatment method, were recorded as patients lost to follow-up.

The participants completed the assessments anonymously and kept the condition confidential. The data obtained were only used for this study and not for profit.

The researchers provided uniform training and instruction to the data collectors. A questionnaire survey was conducted by adopting the "Endoscopic Dilation of Patient Files" and MDASI.

The diameter of the esophageal stenosis before and after dilation, the amount of bleeding, and the pain score of patients during dilation were recorded by the data collector during dilation. After the dilation was completed, the patient/family member completed the "Endoscopic Dilation of Patient File" independently, and the data collector gave unified guidance and collected the data on site to ensure that there were no missing items.

One week after the patient's dilation, the patient was asked to return an MDASI survey to the hospital. The patients who were able to return to the hospital were reminded by the data investigator in advance by phone after they provided consent. The patients who were unable to return to the hospital were administered the questionnaire by the data investigator on site to ensure that there were no missing items in the questionnaire. The patients who could complete the investigation were given exquisite gifts and publicity materials by the project team to improve patient compliance.

The secretary was trained to properly arrange the data, sort the patients' "Endoscopic Dilation of Patient Files", and manage them properly.

Statistical analysis

SPSS13.0 was used for data analyses. Frequencies, standard deviations, percentages, and means were used to describe the patient's general information, disease-related data, expansion-related records, and the total score and individual scores of each symptom of each expansion interval.

ANOVA was used to compare the scores corresponding to R1, R2, R12, and R2-R1 with symptom distress during the interval of dilation and to establish a linear model to explore the changes and time effects.

Pearson correlation analysis was used to analyze the correlation between the symptom distress score during each dilation interval and the esophageal diameter (R2) after the previous dilation, the esophageal diameter (R12) before the next dilation, and the effect of the previous dilation (R2-R1).

RESULTS

Dilatation times of esophageal carcinoma patients repeatedly undergoing dilation for esophageal stenosis

In this study, only three (2.86%) patients achieved a marked effect after one dilation, six achieved a marked effect after two dilations, and 40.95% (43 patients) achieved a marked effect after three dilations, which accounted for the largest proportion. Forty (38.10%) patients needed more than four dilations, among whom 13 (16.19%) failed to achieve significant effects after six dilations. The median number of dilations was three (Table 1)

Dilatation effect of esophageal carcinoma patients repeatedly undergoing dilation for esophageal stenosis

As the number of dilations increased, the esophageal diameter (R1) increased ($P < 0.05$) when the patient was recanalized, and the degree of stenosis improved from moderate stenosis ($R11 = 5.16 \pm 1.67$ mm) to mild stenosis ($R17 = 8.21 \pm 3.41$ mm). After dilation, the diameter (R2) increased ($P < 0.05$) and reached a level of no stenosis (> 10 mm) at the end of each dilation. The amount by which the esophageal diameter increased (R2-R1) gradually decreased with increasing dilation times, and the difference was statistically significant ($P < 0.05$), as shown in Table 2 and Figure 1.

Symptoms distress of esophageal carcinoma patients repeatedly undergoing dilation for esophageal stenosis

The total symptom distress score in patients with esophageal carcinoma who underwent repeated esophageal stenosis and dilation was significantly increased with

Table 1 Dilatation times in esophageal carcinoma patients repeatedly undergoing dilation for esophageal stenosis

	Achieved marked effect			Did not achieve significant results	
	<i>n</i>	Percentage (%)	Cumulative percentage	<i>n</i>	Percentage (%)
1 time	3	2.86	2.86	102	97.14
2 times	6	5.88	8.57	96	94.12
3 times	43	44.79	49.52	53	55.21
4 times	5	9.43	54.29	48	90.57
5 times	18	37.50	71.43	30	62.50
6 times	17	56.67	87.62	13	43.33

Table 2 Dilatation effect in esophageal carcinoma patients repeatedly undergoing dilation for esophageal stenosis

	1 st time (<i>n</i> = 105)	2 nd time (<i>n</i> = 102)	3 rd time (<i>n</i> = 96)	4 th time (<i>n</i> = 53)	5 th time (<i>n</i> = 48)	6 th time (<i>n</i> = 30)	7 th time (<i>n</i> = 13)	FIP value
R1 (mm)	5.16 ± 1.67	5.65 ± 0.99	6.37 ± 0.67	6.99 ± 1.18	7.27 ± 2.10	7.85 ± 2.74	8.21 ± 3.41	34.71/0.01 ^a
R2 (mm)	12.06 ± 2.92	12.27 ± 2.13	12.24 ± 1.69	12.62 ± 1.44	12.65 ± 2.39	13.27 ± 1.63	13.97 ± 2.11	16.95/0.00 ^a
R2-R1 (mm)	6.90 ± 1.03	6.62 ± 0.99	5.87 ± 1.54	5.63 ± 0.89	5.38 ± 1.41	5.42 ± 1.10	5.76 ± 0.84	3.29/0.00 ^a

^a*P* < 0.05.

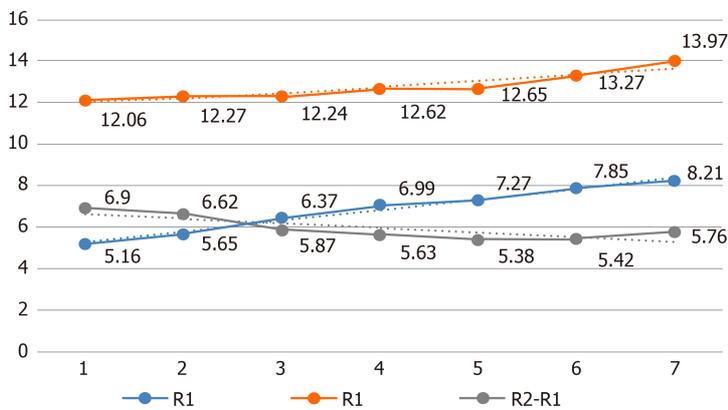


Figure 1 Dilatation effect in esophageal carcinoma patients with repeated dilation for esophageal stenosis.

the number of dilations (*P* < 0.05). The symptom dimension and distress dimension scores were significantly increased with the number of dilations (*P* < 0.05), as shown in Table 3 and Figure 2. Dysphagia and pain were the most common symptoms after the 1st to 4th dilations. Sadness, fatigue, and weight loss were the most common symptoms after the 5th to 7th dilations. In the investigation of patients' distress after each dilation, the most common types of distress were work-related, emotional, general activity-related, and general life-related distress (Table 4 and Table 5).

Correlation between symptom distress and dilatation effect in esophageal carcinoma patients repeatedly undergoing dilation for esophageal stenosis

In the correlation scores between symptom distress and dilatation effect of esophageal carcinoma patients who repeatedly undergo dilation for esophageal stenosis, the symptom distress scores of the patients were negatively (*P* < 0.05) correlated with the previous dilation effect (R2-R1) and the esophageal diameter (R2) after the previous dilation. After the 1st to 4th dilations, the patient's symptom distress score was

Table 3 Symptom distress score (mean \pm SD) of esophageal cancer patients who underwent repeated dilation for esophageal stenosis

	After the 1 st dilation (n = 105)	After the 2 nd dilation (n = 102)	After the 3 rd dilation (n = 96)	After the 4 th dilation (n = 53)	After the 5 th dilation (n = 48)	After the 6 th dilation (n = 30)	After the 7 th dilation (n = 13)	F/P value
Total score	185.49 \pm 15.04	190.62 \pm 14.83	189.11 \pm 12.76	191.37 \pm 14.20	193.55 \pm 12.37	192.17 \pm 15.10	194.04 \pm 11.21	38.97/ 0.00 ^a
Symptom dimension	106.37 \pm 8.79	111.08 \pm 5.99	108.39 \pm 4.11	110.35 \pm 8.37	114.70 \pm 6.81	110.24 \pm 7.28	112.33 \pm 9.10	14.24/ 0.00 ^a
Distress dimension	79.12 \pm 2.66	79.54 \pm 1.09	80.72 \pm 1.37	81.02 \pm 1.57	78.85 \pm 1.98	81.93 \pm 2.19	81.71 \pm 6.68	17.64/ 0.00 ^a

^a $P < 0.05$.

negatively correlated with the esophageal diameter (R12) before the next dilation, while there was no significant correlation ($P > 0.05$) with the other dilations (Table 6 and Table 7).

DISCUSSION

General situation of patients undergoing repeated dilation for esophageal stenosis

In patients with esophageal stenosis, restenosis can easily occur. In this study, only three (2.86%) patients achieved a remarkable effect after one dilation operation. In total, 87.62% (102 cases) of the patients received four dilation operations to achieve complete remission of symptoms. Among them, more than half (57 cases, 54.29%) of the patients achieved a marked effect within four times, and 17 (16.19%) patients still had no marked effect after seven dilations. In clinical practice, there are also patients with such refractory esophageal stenosis. Repeated mechanical dilations cannot achieve the goal of a complete resolution of symptoms. The treatment outcome may be related to the patient's individual anatomical characteristics, disease pathogenesis, treatment mechanism, or other factors. Additional discussion on the mechanism is needed with the support of clinical experiments^[8].

Dilatation effect in patients with repeated dilation for esophageal stenosis

The degree of stenosis usually reaches the level of moderate stenosis (R11 = 5.16 \pm 1.67 mm) when patients seek medical treatment for the first time, which seriously affects patients' intake of food and water. Adequate nutritional support is an important aspect to ensure proper postoperative rehabilitation of esophageal carcinoma patients^[19]. Therefore, esophageal stenosis not only seriously affects the quality of life of patients but also affects the rehabilitation outcome and disease prognosis of patients. After endoscopic treatment of esophageal stenosis, the esophageal diameter of the patient can reach a nonstenosis state (> 10 mm) immediately, ensuring that the patient can obtain timely nutritional support after dilation. Due to the anatomical features of the esophagus, patients with an immediate effect of dilation still have the possibility of restenosis, so it is necessary to perform dilation again when food intake is affected after restenosis. In this study, the severity of esophageal restenosis (R1) of the patients after treatment was somewhat less than that before treatment. Before the 7th dilation, the average severity of esophageal stenosis was mild stenosis (R17 = 6.31 \pm 3.41 mm). This result indicates that dilation for esophageal stenosis can continuously improve the severity of esophageal stenosis in patients and alleviate the severity of restenosis. The diameter of the esophagus (R2) increased after dilation, but judging from the trend chart, the growth trend of R2 was moderate. As the number of dilations increased, the esophageal diameter difference (R2-R1) before and after dilation decreased compared with that before dilation. The marked reduction in the effect of dilation on esophageal stenosis may be related to the reduction in elasticity and toughness of the esophageal wall caused by the disease characteristics of some patients, repeated mechanical injury-hyperplasia trauma processes, and limited expansion effects.

Table 4 Symptom incidence and item score in esophageal carcinoma patients repeatedly undergoing dilation for esophageal stenosis

After the 1 st dilation (n = 105)			After the 2 nd dilation (n = 102)			After the 3 rd dilation (n = 96)			After the 4 th dilation (n = 53)			After the 5 th dilation (n = 48)			After the 6 th dilation (n = 30)			After the 7 th dilation (n = 13)		
Item	%	mean ± SD	Item	%	mean ± SD	Item	%	mean ± SD	Item	%	mean ± SD	Item	%	mean ± SD	Item	%	mean ± SD	Item	%	mean ± SD
Dysphagia	63.2	6.4 ± 1.8	Dysphagia	58.9	6.2 ± 1.6	Dysphagia	69.1	6.7 ± 2.4	Distress	78.4	7.3 ± 2.6	Sadness	77.4	7.5 ± 3.1	Cough	78.1	7.3 ± 1.9	Sadness	79.6	7.9 ± 2.8
Pain	61.1	5.8 ± 2.3	Cough	56.6	6.1 ± 2.3	Weight loss	69.3	7.1 ± 1.8	Dysphagia	70.6	6.9 ± 3.1	Cough	73.9	6.6 ± 2.4	Sadness	77.5	7.3 ± 2.6	Fatigue	70	7.1 ± 1.7
Distress	57.3	6.1 ± 2.1	Pain	51.2	6.6 ± 1.4	Pain	67.9	6.8 ± 2.1	Fatigue	68.3	7.6 ± 2.2	Weight loss	70.1	7.1 ± 3.6	Fatigue	73.1	7.6 ± 2.7	Weight loss	69.5	6.9 ± 2.4

Table 5 Distress incidence and item score in esophageal carcinoma patients repeatedly undergoing dilation for esophageal stenosis

After the 1 st dilation (n = 105)			After the 2 nd dilation (n = 102)			After the 3 rd dilation (n = 96)			After the 4 th dilation (n = 53)			After the 5 th dilation (n = 48)			After the 6 th dilation (n = 30)			After the 7 th dilation (n = 13)		
Item	%	mean ± SD	Item	%	mean ± SD	Item	%	mean ± SD	Item	%	mean ± SD	Item	%	mean ± SD	Item	%	mean ± SD	Item	%	mean ± SD
Work	49.3	4.7 ± 1.1	Work	56.7	4.8 ± 1.4	Emotion	56.2	4.7 ± 2.3	Emotion	57.3	5.1 ± 2.4	Life fun	49.6	4.7 ± 2.2	Life fun	51.4	5.2 ± 3.0	General activities	54.8	5.2 ± 2.4
Emotion	49	4.2 ± 1.2	Emotion	52.5	4.6 ± 2.2	General activities	40.6	4.2 ± 1.6	Life fun	40.7	4.5 ± 1.8	2 Emotion	48.1	4.9 ± 1.3	General activities	37.2	5.0 ± 2.9	Emotion	43.7	5.3 ± 1.7
General activities	32.1	3.8 ± 0.9	Life fun	50.9	3.9 ± 1.7	Life fun	37.3	4.1 ± 2.0	General activities	40.7	4.1 ± 2.3	3 General activities	31.7	4.9 ± 2.4	Emotion	37	4.9 ± 1.8	Life fun	42.9	3.9 ± 1.1

Symptom distress level of patients undergoing esophageal stenosis dilation

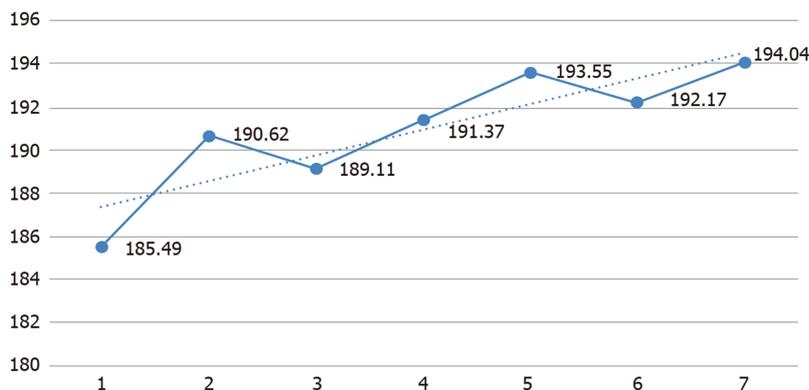
The symptom distress levels of esophageal carcinoma patients who have undergone repeated dilation of esophageal stenosis increase with the number of dilations. In this study, more than half (57 cases, 54.29%) of the patients were able to achieve a marked effect within four times, three achieved a marked effect after one dilation operation, and six achieved a marked effect after two dilation operations. Therefore, for these patients, the curative effect of dilation was remarkable and timely, and the experience of physical symptoms, such as dysphagia and pain, and the experience of distress in aspects such as work, emotions, and life enjoyment were relatively low. Moreover, due to an obvious relief in esophageal stenosis and lower levels of distress in the patients' life, a lower number of dilations corresponded to a lower average level of disease uncertainty during the patient's stay at home. Forty patients (38.10%) who needed more than four dilations, 17 (16.19%) of them failed to achieve significant effects after seven dilations. For these patients, repeated and continuous symptoms, such as pain, hemorrhage, and fear, caused by treatment methods leading to multiple mechanical injuries last for a long time. Repeated esophageal narrowing affects the intake of food

Table 6 Correlation between symptom distress and dilatation effect in esophageal carcinoma patients repeatedly undergoing dilation for esophageal stenosis (*r*)

	Symptom distress after the 1 st dilation (<i>n</i> = 105)	Symptom distress after the 2 nd dilation (<i>n</i> = 102)	Symptom distress after the 3 rd dilation (<i>n</i> = 96)	Symptom distress after the 4 th dilation (<i>n</i> = 53)	Symptom distress after the 5 th dilation (<i>n</i> = 48)	Symptom distress after the 6 th dilation (<i>n</i> = 30)	Symptom distress after the 7 th dilation (<i>n</i> = 13)
R2-R1	-0.356 ^a	-0.332 ^a	-0.665 ^a	-0.157 ^a	-0.675 ^a	-0.293 ^b	-0.273 ^a
R2	-0.185 ^a	-0.257 ^a	-0.392 ^a	-0.366 ^a	-0.119	-0.665 ^a	-0.227 ^a

^a*P* < 0.05.^b*P* < 0.01.**Table 7 Correlation between symptom distress and severity of esophageal restenosis in esophageal carcinoma patients repeatedly undergoing dilation for esophageal stenosis (*r*)**

	Symptom distress after the 1 st dilation (<i>n</i> = 105)	Symptom distress after the 2 nd dilation (<i>n</i> = 102)	Symptom distress after the 3 rd dilation (<i>n</i> = 96)	Symptom distress after the 4 th dilation (<i>n</i> = 53)	Symptom distress after the 5 th dilation (<i>n</i> = 48)	Symptom distress after the 6 th dilation (<i>n</i> = 30)
R12	0.304 ^b	-0.306 ^a	-0.311 ^b	-0.565 ^b	-0.198	-0.278

^a*P* < 0.05.^b*P* < 0.01.**Figure 2 Scores of symptom distress for esophageal carcinoma patients repeatedly undergoing dilation for esophageal stenosis.**

and water for the patients, and the inability to eat food leads to difficulties in the life of the patients during the recovery period, which further affects the symptom distress level of the patients at home.

In terms of the incidence of symptoms, dysphagia and pain were among the three most common symptoms after the first to third dilations, while after the fourth to seventh dilations, sadness, fatigue, weakness, weight loss, and cough were more frequent. The results show that when patients experience fewer dilations, swallowing obstruction caused by the disease itself and pain caused by dilation therapy are more significant. With an increase in the number of dilations, the severity of esophageal restenosis in patients decreases, dysphagia improves, and patients experience less pain and other symptoms. The incidence rate of the corresponding symptoms is significantly reduced compared with those of other symptoms. However, the cost associated with patients' diseases and treatment for patients is increasingly prominent. Among the symptoms experienced by patients, weight loss and fatigue are very important. Repeated treatment often makes patients feel uncertain about the treatment and thus feel sad. Repeated mechanical injuries may cause damage to the mucosa, muscles, and nerves in the esophageal wall, and patients with more dilations are more likely to choke.

Judging from the incidence rate of various distress items, diseases and treatments continue to negatively affect patients' emotions, enjoyment in life, and general activities. During the first and second dilations, distress from the disease and treatment most affected the patient's work, which may be related to the fact that some patients felt more strongly that the disease caused them to stop/give up their work at the early stage of stenosis.

Correlation between symptom distress and dilatation effect in patients undergoing esophageal stenosis dilatation

Correlation between symptom distress and dilation effect (R2-R1) and esophageal diameter (R2) after the previous dilation in patients undergoing esophageal stenosis dilation: In the correlation scores between symptom distress and the dilation effect of esophageal cancer patients who underwent repeated dilation of esophageal stenosis, the symptom distress scores of the patients were negatively ($P < 0.05$) correlated with the previous dilation effect (R2-R1) and the esophageal diameter (R2) after the previous dilation. The better the patient's current expansion effect, the greater the difference in (R2-R1), and the lower the symptom distress level during the patient's stay at home. Endoscopic esophageal stenosis dilation can immediately enlarge the esophageal diameter. Therefore, patients can eat a warm and cool liquid diet 2 h after dilation. The improvement in a patient's ability to feed himself or herself can greatly reduce the symptoms and severity of dysphagia, eating obstruction, and similar issues. Therefore, the better the dilation effect, the larger the diameter of the esophagus, the lower the symptom distress score, and the lower the level of symptom distress during the patient's stay at home.

Correlation between symptom distress and esophageal restenosis degree (R12) in patients undergoing esophageal stenosis dilatation: After the 1st to 4th dilations, the patient's symptom distress score was negatively correlated with the esophageal diameter (R12) before the next dilation, while there was no significant correlation ($P > 0.05$) with the other dilations. During the home rehabilitation period, the higher the symptom distress level, *i.e.*, the more severe the symptoms experienced by the patient, such as dysphagia and eating obstruction, the higher the level of distress in the patient's life. This association may be related to the presence of the patient's esophageal restenosis during his or her stay at home, or it may be related to the patient's personal emotional characteristics. This study indicated that the higher the symptom distress level of the patient before the previous dilation, the higher the esophageal restenosis degree before the next dilation, *i.e.*, R12 is smaller. It was shown that the symptom distress level of patients in this study is obviously related to the progression of esophageal restenosis, suggesting that nursing staff should pay close attention to the symptom distress level of patients during home rehabilitation and suggest patients to receive endoscopic reexaminations in a timely manner. If esophageal restenosis has occurred, it is recommended that the next esophageal dilation be performed at an earlier time.

In conclusion, for esophageal carcinoma patients who have undergone repeated dilation of esophageal stenosis, the dilation effect and the diameter of the esophagus after dilation are closely related to the degree of symptom distress during the patient's stay at home. The higher the degree of symptom perplexity, the more obvious the degree of esophageal stenosis in patients who underwent dilation in the early stage. As the number of dilations increases, the effect of dilations decreases significantly, and the level of symptom distress during the patient's stay at home also increases. The results of this study suggested that the formulation of intraoperative nursing programs and the improvement in patients' adherence can yield a better dilatation effect, which can help reduce the level of symptoms and distress in patients during their stay at home. Moreover, strict follow-ups and home symptom management are helpful for timely assessments of the patient's symptom distress level, indirect assessments of the degree of esophageal restenosis before the next dilation, and timely suggestions for the patient's dilation schedule. For patients who have failed to achieve the ideal effect after repeated dilations for esophageal stenosis, especially for patients who have undergone dilation more than four times, nursing workers should pay more attention to the level of symptom distress and strengthen symptom management.

ARTICLE HIGHLIGHTS

Research background

There are many research studies on symptom distress in tumor patients at home and abroad, but for esophageal carcinoma patients who need repeated esophageal dilation, the symptom distress levels and changes have not been mentioned in any research studies.

Research motivation

The results can be used as a basis for symptom management.

Research objectives

This study aimed to investigate the changes in the esophageal diameter and symptom distress level in patients during the interval of dilation as the number of dilations increases to explore the dilation effect and its correlation with symptom distress level.

Research methods

The difference between the diameter of the esophageal stenosis opening of the patients before dilation and the diameter of the esophageal stenosis opening after dilation was calculated to describe the extent and expansion of the esophageal stenosis before and after dilation.

Research results

The diameter of the esophagus (R1) increased before each dilation in patients undergoing esophageal dilation. The diameter (R2) increased after dilation, and the dilation effect (R2-R1) decreased with the number of dilations. The total symptom distress score increased with the number of dilations, and the difference was statistically significant. After the 1st to 4th dilations, the patient's symptom distress score was negatively correlated with the esophageal diameter (R12) before the next dilation, while there was no significant correlation with the other dilations.

Research conclusions

For esophageal carcinoma patients who have undergone repeated dilation of esophageal stenosis, the dilation effect and the diameter of the esophagus after dilation are closely related to the degree of symptom distress during the patient's stay at home.

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