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Research on Endoscopic C-Blart (Clip Band Ligation Anti-reflux Therapy) for the Treatment of Cardiac Relaxation

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Abstract: This study analyzes the efficacy of endoscopic C-Blart (clip band ligation anti-reflux therapy), an emerging surgical procedure, in treating cardiac relaxation and evaluates its therapeutic effectiveness and safety. A randomized controlled trial was conducted, enrolling patients with cardiac relaxation according to relevant criteria. Pre- and post-operative examination indicators and symptom improvements were compared, while postoperative complications were also analyzed. Based on clinical practice analysis, endoscopic C-Blart effectively alleviated symptoms such as heartburn and reflux in patients, improved objective examination indicators, and reduced the incidence of complications. These findings provide a scientific basis for the treatment of cardiac relaxation and suggest that endoscopic C-Blart is a relatively safe procedure.

Keywords: Cardiac relaxation; Endoscopic C-Blart; Gastroesophageal reflux disease; Therapeutic effect

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1. Introduction

1.1. Research background

Gastroesophageal Reflux Disease (GERD) presents a high clinical incidence risk, primarily attributed to cardiac relaxation, which can induce and accelerate the progression of GERD. As a motility disorder, GERD is characterized by the reflux of gastric contents into the esophagus, oropharynx, trachea, etc., primarily caused by dysfunction of the Lower Esophageal Sphincter (LES) [1]. With the improvement in social living standards and changes in dietary patterns, the number of GERD cases has been increasing annually, with an overall prevalence rate of approximately 12.5% in China [2]. Clinically, Proton Pump Inhibitors (PPIs) are commonly used as first-line treatment for GERD, providing rapid relief of symptoms. However, long-term PPI use in GERD patients can lead to a series of complications, such as osteoporosis and infections. Additionally, approximately 40% of GERD patients are insensitive to PPI treatment, developing Refractory Gastroesophageal Reflux Disease (RGERD) as the disease progresses [3]. Given this background, exploring

novel treatment options for cardiac relaxation is crucial. Endoscopic C-Blart, a minimally invasiveprocedure, can tighten the cardiac region and restore the tension of the lower esophageal sphincter, thereby preventing gastric acid reflux. Compared to conventional treatments for cardiac relaxation, endoscopic C-Blart offers advantages such as minimal invasiveness and rapid postoperative recovery, presenting promising prospects [1,2].

1.2. Problem statement

Currently, numerous treatment options for cardiac relaxation are available in China, including lifestyle modifications, pharmacological therapy, and surgical interventions. However, conventional treatment regimens still require optimization. Although traditional pharmacological treatments like PPIs can rapidly alleviate symptoms in patients with cardiac relaxation, recurrence is common after discontinuation, and long-term PPI use may increase the risk of complications [4]. Surgical interventions, such as fundoplication, demonstrate excellent efficacy in treating cardiac relaxation but are invasive procedures that some patients, particularly the elderly, may not tolerate due to health limitations [5]. Furthermore, some patients with cardiac relaxation respond poorly to conventional treatments, leading to prolonged illness and poor quality of life [6]. Therefore, exploring efficient and safe treatment modalities is crucial to accelerate the recovery of patients with cardiac relaxation. With the maturation of minimally invasive concepts, endoscopic C-Blart has gradually been applied in the treatment of cardiac relaxation. Positioned between pharmacological and surgical treatments, it offers simple operation and a low risk of complications, representing a significant breakthrough in supplementing conventional treatment regimens [7]. However, it should be noted that the long-term efficacy and indications for endoscopic C-Blart still lack clinical data support, necessitating further in-depth clinical research.

1.3. Objectives

This study systematically evaluates the efficacy, safety, and long-term outcomes of endoscopic C-Blart in patients with cardiac relaxation, aiming to provide evidence for future clinical treatment of this condition. A randomized controlled trial was conducted to compare the therapeutic effects of traditional pharmacological therapy and endoscopic C-Blart, analyzing differences in indicators such as the recurrence rate of cardiac relaxation and symptom improvement in patients. Additionally, objective indicators such as gastroscopy and 24-hour esophageal pH-impedance monitoring were evaluated to assess efficacy comprehensively [7]. Furthermore, this study focuses on analyzing postoperative complications and explores the safety of endoscopic C-Blart in-depth, aiming to provide a basis for physicians to individually adjust treatment regimens for patients with cardiac relaxation [6]. This study aims to offer better options for treating cardiac relaxation and related diseases, thereby optimizing the quality of life for patients with cardiac relaxation.

2. Literature review

2.1. Theoretical basis

Cardiac relaxation is a functional disorder primarily caused by structural changes in the gastroesophageal junction (GEJ) and dysfunction of the lower esophageal sphincter (LES). The esophageal sphincter is a crucial component of the body's anti-reflux barrier, maintaining a certain resting pressure and exhibiting periodic relaxation characteristics in a healthy state, thereby inhibiting the retrograde flow of gastric contents

into the esophagus [5]. However, a decrease in LES pressure or frequent uncoordinated relaxation can increase the risk of GERD. Additionally, anatomical abnormalities in the gastroesophageal junction, such as hiatal hernia, can further weaken the anti-reflux barrier function, thereby inducing cardiac relaxation [3]. From a physiological perspective, the mucosal and muscular layers of the cardiac region play important roles in maintaining local normal physiological function. However, disruption of the structural integrity of the mucosa and muscular layers can exacerbate cardiac relaxation. Based on clinical practice, factors such as reduced salivary defense capacity, acid pocket formation, or *Helicobacter pylori* infection can affect cardiac function and even exacerbate reflux symptoms in patients [5].

2.2. Development of C-Blart

Endoscopic C-Blart is a modern minimally invasive procedure that has emerged against the backdrop of rapid advancements in endoscopic technology, offering high safety. Various endoscopic treatment options for GERD exist, including radiofrequency therapy and endoscopic injection therapy. However, adverse reactions during pharmacological treatment limit its clinical application in GERD patients [5].

With continuous improvements in treatment techniques for cardiac relaxation, peroral endoscopic cardiac constriction (PECC) has gradually matured and become an important treatment option for GERD. As early as 2013, Professor Linghu Enqiang proposed the concept of PECC and validated its clinical feasibility [1]. Building on this foundation, multiple studies have conducted in-depth research on endoscopic C-Blart. For instance, scholars such as Hu Haiqing believe that PECC offers advantages such as minimal trauma and simple operation, reducing the frequency and duration of reflux in patients without severe complications during treatment [5]. Meanwhile, scholars like Zhou Junran further explored the feasibility of PECC and found that it can repair the valve structure at the gastroesophageal junction, achieving long-term anti-reflux effects [3]. In summary, PECC holds significant clinical application value.

2.3. Research achievements and limitations

Endoscopic C-Blart has been widely promoted and applied in the treatment of cardiac relaxation, demonstrating excellent performance in terms of treatment safety and efficacy. Based on clinical practice, PECC reduces the severity of GERD, decreases the frequency of reflux, alleviates esophageal pressure, lowers esophageal pH, and optimizes patients' quality of life in the short term [8]. In a study by scholars such as Li Honggang, it was found that patients receiving PECC treatment experienced a reduction in the frequency of acid reflux and total reflux events, as well as a shortening of the longest reflux duration within two months postoperatively, with an overall effectiveness rate of 95.83% [8]. However, current research on PECC treatment still has limitations, such as the lack of large-scale follow-up on the long-term efficacy of PECC, resulting in limitations in evaluating its long-term anti-reflux effects [6]. Additionally, clinical treatment standards for PECC have not been clearly established, and differences in inclusion and exclusion criteria across studies limit the generalizability of treatment results [2]. Furthermore, the prevention and management of postoperative complications in PECC treatment for cardiac relaxation still require optimization to enhance surgical safety further and improve patient satisfaction [6].

3. Research methodology

3.1. Study subjects

3.1.1. Inclusion and exclusion criteria

Inclusion criteria were established based on clinical symptoms, imaging results, and the general condition of patients, primarily as follows: presence of typical symptoms of cardiac relaxation such as frequent reflux, belching, and heartburn; diagnosis of cardiac relaxation confirmed by high-definition electronic gastroscopy [6]. Physiologically mature patients aged ≥ 18 years who can tolerate surgery; patients with refractory cardiac relaxation who have shown poor response to previous proton pump inhibitor (PPI) therapy [9]. Patients who can tolerate PECC surgery, including preoperative preparation, surgical procedure, and postoperative care. Exclusion criteria were established based on comorbidities that may affect the study results, primarily as follows: patients with Barrett's esophagus; patients with esophageal varices; patients with severe hiatal hernia; patients with fungal esophagitis; patients with heterogeneous hyperplasia of the cardiac mucosa; patients with early-stage tumors; patients intolerant to gastroscopy; patients with severe cardiovascular and cerebrovascular diseases; patients with allergies to treatment medications; patients with mental disorders; patients with hepatic or renal insufficiency; and patients unable to participate throughout the study [9]. Strict adherence to the aforementioned inclusion and exclusion criteria was ensured to guarantee the homogeneity of the included samples and enhance the reliability of the study results.

3.1.2. Sample size determination

The sample size was calculated based on statistical principles to ensure sufficient statistical power for the study. This study employed a randomized controlled trial design, with sample size estimation based on three key parameters: expected effect size, significance level (α), and power (1-β). According to the literature, the effectiveness rate of endoscopic C-Blart for treating cardiac relaxation ranges from approximately 80% to 90% [7,8]. Therefore, the expected effectiveness rate was set at 85% for the experimental group and 60% for the control group. Using a two-sided significance level of $\alpha = 0.05$ and a power of $1-\beta = 0.8$, the PASS software calculated that 24 cases were required per group, totaling 48 cases. Considering potential patient loss to follow-up or missing data, the sample size was ultimately expanded to 30 cases per group, totaling 60 cases [10]. This sample size not only ensures the statistical significance of the study results but also reduces the impact of random errors on the conclusions to a certain extent, thereby providing reliable data support for the study.

3.2. Study design

This study conducted a randomized controlled trial to thoroughly analyze the efficacy of endoscopic C-Blart in treating patients with cardiac relaxation. Sixty study subjects were included and randomly divided into two groups: 30 patients in the experimental group received endoscopic cardiac constriction combined with pharmacological therapy, while 30 patients in the control group received conventional pharmacological therapy alone. In the experimental group, patients with cardiac relaxation were instructed to fast for 6 hours before surgery and underwent endoscopic C-Blart under general anesthesia. During the procedure, the gastroscopic imaging system was used to observe intra-gastric lesions, and a ligation device was employed to ligate the cardiac mucosa precisely. After completing the aforementioned operations, titanium clips were used to fix the root to ensure surgical efficacy as much as possible [6]. Following surgical treatment, patients in the experimental group continued to take domperidone and

omeprazole for 4 weeks. Patients in the control group received only domperidone and omeprazole, with the same dosage as the experimental group. Conducting a controlled trial enables the exclusion of the influence of medications on the intervention results, thereby accurately assessing the efficacy of endoscopic C-Blart [2]. Based on this, patients with cardiac relaxation in this study were followed up to ensure the reliability of data comparison.

3.3. Observation indicators

3.3.1. Clinical symptom indicators

This study utilized the Gastroesophageal Reflux Disease Questionnaire (GerdQ) to assess patients' clinical symptoms, focusing on the frequency and severity of reflux, heartburn, upper abdominal pain, nausea, nighttime sleep, and medication days. The GerdQ requires patients to score their symptoms based on occurrences over the past 7 days, with each item scored on a scale of 0–3 and a total score range of 0–18. A higher score indicates more severe clinical symptoms [8,11]. Additionally, this study recorded specific indicators such as the total number of reflux episodes, acid reflux episodes, weakly acid reflux episodes, and non-acid reflux episodes to analyze symptom improvement quantitatively. Changes in GerdQ scores before and after treatment can visually reflect the alleviating effect of endoscopic C-Blart on patients'clinical symptoms.

3.3.2. Objective examination indicators

Objective examination indicators primarily included gastroscopy and 24-hour esophageal pH-impedance monitoring. Gastroscopy was used to assess the mucosal condition of the lower esophagus, observe for inflammation, erosion, or other abnormal manifestations, and record the degree of hiatal hernia and improvement in cardiac relaxation [7,11]. Twenty-four-hour esophageal pH-impedance monitoring was employed to evaluate acid reflux, with specific indicators including the DeMeester score, total number of reflux episodes, number of long reflux episodes, duration of long reflux episodes, and proximal reflux rate. Among these, the DeMeester score is an important indicator for assessing the severity of acid reflux, with a higher score indicating more severe acid reflux [11]. By comparing changes in these objective indicators before and after treatment, the therapeutic effect of endoscopic C-Blart and its improvement in patients' esophageal function can be further verified.

3.4. Statistical analysis methods

This study utilized SPSS 26.0 software for data statistical analysis, selecting appropriate statistical methods for testing based on data type. For measurement data, such as age, disease duration, GerdQ scores, and esophageal 24-hour pH-impedance monitoring indicators, independent sample *t*-tests were used for intergroup comparisons of data that followed a normal distribution and had homogeneous variances, with results expressed as mean ± standard deviation ($\overline{x} \pm s$). Paired sample *t*-tests were used for intragroup comparisons before and after treatment [10]. If the data did not meet these assumptions, non-parametric tests were employed, with results expressed as the median. For count data, such as gender ratio and complication incidence rate, percentages (%) were used for expression, and chi-square tests (χ^2 tests) were used for intergroup comparisons. All statistical tests were two-sided, with $p < 0.05$ indicating a statistically significant difference. Additionally, this study conducted multivariate regression analysis on factors that may affect

the results to exclude the interference of confounding factors, thereby ensuring the scientific validity and reliability of the study results [10].

4. Operative procedure of endoscopic C-Blart

4.1. Preoperative preparation

Endoscopic C-Blart is a modern minimally invasive interventional procedure, and excellent preoperative preparation can ensure the smooth progress of the surgery. Before performing endoscopic C-Blart, it is necessary to strictly prohibit food and water intake for 6 hours to maintain an empty stomach and avoid restricted intraoperative visualization and aspiration during the procedure [6]. Additionally, patients should be guided to complete a comprehensive preoperative assessment, including medical history inquiry, physical examination, and laboratory tests, to exclude patients with contraindications to surgery. Choosing an appropriate anesthesia method can enhance surgical safety, as this type of surgery is mostly performed under general anesthesia, ensuring that patients remain calm and pain-free during the procedure. Before anesthesia induction, emergency medications and equipment should be prepared to respond appropriately to unexpected situations. The equipment and instruments should be checked in advance to ensure they meet surgical requirements, such as examining the performance of the ligation device, endoscopic imaging system, and titanium clips, and ensuring that these devices are sterile. During the actual surgery, the endoscopic imaging system can assist the surgeon in observing lesions within the esophagus, providing clear images of the affected area to guide precise surgical manipulation. The ligation device is an important instrument used to ligate the mucosa and muscular layer of the lower esophagus. Titanium clips are primarily used to secure the ligation site, preventing early postoperative loosening or detachment [6].

4.2. Surgical steps

The key steps of endoscopic C-Blart mainly include the placement of the ligation device, ligation operation, and securing with titanium clips. During the actual surgical procedure, after the anesthesia takes effect, the surgeon slowly inserts an electronic endoscope through the esophagus and uses the endoscopic imaging system to observe lesions within the esophagus, accurately reflecting the location and degree of cardiac relaxation in the patient. Subsequently, the surgeon places the ligation device at the front end of the endoscope and slowly advances it toward the lower esophagus until it reaches 1 cm from the cardia. During this process, a suction device is used to connect the mucosa and muscular layer of the proximal stomach and esophagus, ensuring accurate ligation placement. During the actual ligation operation, precise control of suction pressure and ligation force is essential to avoid damaging adjacent normal tissues or incomplete ligation. Immediately after ligation, titanium clips are used to secure the ligation site to enhance stability and reduce postoperative complications [6]. Additionally, the entire endoscopic C-Blart should be performed under sterile conditions by experienced endoscopists to ensure surgical safety as much as possible. During the procedure, images or diagrams should be used to adjust surgical steps to facilitate understanding of technical details by relevant scholars.

4.3. Postoperative management

The quality of postoperative management significantly affects the recovery and surgical outcomes of patients with cardiac relaxation who undergo endoscopic C-Blart. Postoperative care includes medication

management, dietary guidance, and prevention of complications. Patients with cardiac relaxation should receive dietary guidance after surgery, with instructions to abstain from food and water for 24 hours postoperatively, followed by a gradual transition to a liquid diet based on the recovery of gastrointestinal function, and eventually returning to a normal diet. During this period, dietary adjustments should be individualized based on the patient's specific health status to avoid complications such as improper diet, loosening of the ligation site, and postoperative bleeding [6]. Medication management should also be implemented for patients with cardiac relaxation after surgery, such as routine treatment with proton pump inhibitors like omeprazole and prokinetic agents like domperidone to alleviate adverse stimulation of the esophageal mucosa by gastric acid secretion and accelerate gastric emptying. Furthermore, after endoscopic C-Blart, patients should be closely evaluated for complications such as fever, dysphagia, and chest pain. If any of these abnormalities are detected, relevant preventive and management measures should be immediately initiated, and targeted treatment should be provided after identifying the cause through endoscopic examination [6]. Active postoperative management can effectively reduce postoperative complications and optimize the patient's recovery experience.

5. Research results

5.1. Patient baseline characteristics

This study included 60 patients with cardiac relaxation, comprising 34 males and 26 females, aged between 28 and 65 years, with an average age of 46.5 years. The duration of the disease varied widely among patients, ranging from 6 months to 10 years, with an average duration of 4.2 years. According to the Los Angeles endoscopic grading criteria, the degree of esophageal mucosal lesions in patients was predominantly mild to moderate, with 18 cases classified as LA-A, 30 cases as LA-B, and 12 cases as LA-C, with no LA-D cases. Additionally, all patients exhibited varying degrees of reflux symptoms, such as heartburn and acid regurgitation, which were poorly controlled with proton pump inhibitors. Analysis of patient baseline information revealed that the gender, age, and disease duration distributions were consistent with the characteristics of individuals at high risk for gastroesophageal reflux disease, indicating that the sample in this study was representative [12].

5.2. Improvement in clinical symptoms

Three months after endoscopic C-Blart, the GerdQ scores of patients with cardiac relaxation in both groups decreased, with the experimental group having a lower GerdQ score than the control group ($p < 0.05$). Specifically, in the experimental group, the frequency of reflux symptoms decreased from 2.7 times per week before treatment to 0.73 times per week after treatment, and the frequency of heartburn symptoms decreased from 2.3 times per week before treatment to 0.83 times per week after treatment, with symptom relief rates of 73.3% and 80.0%, respectively. In the control group, the symptom relief rates for reflux and heartburn were 40.0% and 46.7%, respectively ($p < 0.05$). In the experimental group, abdominal pain decreased from 1.77 ± 1.07 before treatment to 0.43 ± 0.57 after treatment, nausea frequency decreased from 1.37 ± 1 before treatment to 0.17 ± 0.38 after treatment, and nighttime sleep disturbance decreased from 1.77 ± 1.25 before treatment to 0.37 ± 0.56 after treatment. These findings suggest that endoscopic C-Blart can effectively alleviate discomfort in patients with cardiac relaxation [8,11].

5.3. Changes in objective examination indicators

Gastroscopy results showed that, three months after treatment, the healing rate of esophageal mucosa in the experimental group was significantly higher than that in the control group (86.7% vs. 56.7%, $p < 0.05$) (see **Table 1** for details). Meanwhile, the indicators of 24-hour esophageal pH-impedance monitoring also demonstrated significant improvement. In the experimental group, the DeMeester score decreased from (52.3 ± 13.92) before treatment to (14.2 ± 6.1) after treatment, the percentage of acid reflux time decreased from (16.3 ± 6.52)% to (4.3 ± 1.84)%, and the total number of reflux episodes decreased from (72 ± 22.72) to (26.53 ± 10.61). All these indicators were significantly better than those in the control group ($p < 0.05$) (see **Table 2** for details). Additionally, the longest reflux duration in the experimental group shortened from (17.17 ± 4.68) minutes to (5.83 ± 3.22) minutes, which was also significantly lower than that in the control group ($p < 0.05$) (see **Table 3** for details). These data indicate that endoscopic C-Blart can not only significantly improve esophageal mucosal lesions but also effectively reduce the occurrence of acid reflux events [7,11].

Table 1. Statistical table of categorical variables in the experimental group and control group

Variable	Level	Overall (n = 60)	Control (n = 30)	Observation (n = 30)	*p* value
Gender	Male	34 (56.7)	19 (63.3)	15 (50.0)	0.297
	Female	26 (43.3)	11 (36.7)	15 (50.0)	
Grade	A	18 (30.0)	9 (30.0)	9 (30.0)	0.792
	B	30 (50.0)	16 (53.3)	14 (46.7)	
	C	12 (20.0)	5 (16.7)	7 (23.3)	
Reflux relief	Relieved	34 (56.7)	12 (40.0)	22 (73.3)	0.009
	Unrelieved	26 (53.3)	18 (60.0)	8 (26.7)	
Heartburn relief	Relieved	38 (63.3)	14 (46.7)	24 (80.0)	0.007
	Unrelieved	22 (36.7)	16 (53.3)	6 (20.0)	
Esophageal mucosal healing	Unhealed	17 (28.3)	13 (43.3)	4 (13.3)	0.01
	Healed	43 (71.7)	17 (56.7)	26 (86.7)	

Table 2. Analysis table of clinical symptom improvement in the experimental group and control group

Symptoms	Mean ± SD		Rank sum test statistic	Rank sum test *p* value
	Observation group	Control group		
GerdQ score (before treatment)	9.63 ± 3.55	10.4 ± 4.05	486.000	0.597
GerdQ score (after treatment)	3.13 ± 1.74	6.73 ± 4.58	663.500	0.001
Reflux (before treatment)	2.27 ± 0.98	2.1 ± 0.66	364.500	0.177
Reflux (after treatment)	0.73 ± 0.64	1.53 ± 0.78	686.000	0.000
Heartburn (before treatment)	2.33 ± 0.8	1.7 ± 0.88	275.000	0.006
Heartburn (after treatment)	0.83 ± 0.53	1 ± 0.79	502.500	0.393
Upper abdominal pain (before treatment)	1.77 ± 1.07	1.9 ± 1.03	480.000	0.647
Upper abdominal pain (after treatment)	0.43 ± 0.57	1.63 ± 1.16	713.000	0.000
Nausea frequency (before treatment)	1.37 ± 1	1.17 ± 0.79	403.000	0.461
Nausea frequency (after treatment)	0.17 ± 0.38	0.6 ± 0.81	580.000	0.017
Nighttime sleep (before treatment)	1.77 ± 1.25	2.1 ± 1.27	532.500	0.187
Nighttime sleep (after treatment)	0.37 ± 0.56	1.27 ± 1.17	653.500	0.001

Table 3. Comparative table of changes in objective examination indicators between the experimental group and control group

Symptom	Observation group (Mean ± SD)	Control group (Mean ± SD)	Rank sum test statistic	Rank sum test *p* value
D score (before treatment)	52.3 ± 13.92	50.17 ± 10.99	417.000	0.630
D score (after treatment)	14.2 ± 6.1	18.87 ± 6.37	649.500	0.003
Reflux percentage (before treatment)	16.3 ± 6.52	13.4 ± 5.64	333.500	0.084
Reflux percentage (after treatment)	4.3 ± 1.84	7.6 ± 4.72	653.000	0.002
Reflux episodes (before treatment)	72 ± 22.72	68.03 ± 12.64	431.000	0.784
Reflux episodes (after treatment)	26.53 ± 10.61	38.83 ± 19.6	615.500	0.015
Reflux duration (before treatment)	17.17 ± 4.68	15.5 ± 6.48	346.000	0.105
Reflux duration (after treatment)	5.83 ± 3.22	9.73 ± 4.68	652.000	0.002

5.4. Incidence of complications

During the postoperative follow-up period, three patients in the experimental group experienced minor complications, including one case of mild dysphagia and two cases of transient chest pain, with a complication rate of 10.0%. All complications were alleviated through conservative treatment, and no serious adverse reactions or surgical failures occurred. In the control group, five patients experienced drug-related side effects, including diarrhea and headaches, with an incidence rate of 16.7%. The difference in complication rates between the two groups was not statistically significant ($p > 0.05$). However, the types of complications in the experimental group were milder and easier to manage, suggesting that endoscopic C-Blart has certain safety advantages [6].

6. Discussion

6.1. Analysis of study results

Endoscopic C-Blart is a modern therapeutic technique that can improve symptoms of cardial relaxation and optimize objective indicators. This study conducted postoperative follow-up on patients with cardial relaxation and found that typical symptoms such as heartburn and reflux were alleviated, and GerdQ scores decreased, indicating that endoscopic C-Blart can relieve patient discomfort [6,8]. This study also conducted an in-depth analysis of objective indicators in patients with cardial relaxation, such as monitoring 24-hour esophageal pH-impedance results. Postoperatively, patients showed decreases in DeMeester scores, acid reflux frequency, and longest reflux duration, along with an increase in lower esophageal sphincter pressure. These changes in objective indicators are consistent with findings reported in related literature [7]. However, it should be noted that although endoscopic C-Blart has excellent short-term efficacy, its long-term efficacy still requires further exploration. Additionally, this study statistically analyzed the complication rate of patients undergoing endoscopic C-Blart and found that most complications were mild adverse reactions, indicating a relatively high safety profile for this procedure [6]. Overall, patients with cardial relaxation who underwent endoscopic C-Blart showed improvements in both clinical symptoms and objective indicators, demonstrating its safety and efficacy [13].

6.2. Comparison with existing studies

Compared with existing literature on the treatment of cardial relaxation, this study innovated in terms of

sample selection and research methods for patients with cardial relaxation and had certain advantages in evaluating treatment efficacy. This study employed strict inclusion and exclusion criteria to ensure the homogeneity of the study population, thereby enhancing the reliability of the results regarding cardial relaxation [2]. A randomized controlled trial was designed to compare the efficacy of endoscopic C-Blart combined with drug therapy versus conventional drug therapy, clarifying the advantages of surgical treatment. Related literature reports that patients with refractory gastroesophageal reflux disease (GERD) treated with peroral endoscopic C-Blart achieved an efficacy rate of 95.83%, which was higher than that of conventional drug therapy [8]. This study introduced objective evaluation indicators related to cardial relaxation, including esophageal 24-hour pH-impedance monitoring via gastroscopy, enabling quantitative analysis of esophageal functional recovery status in addition to evaluating symptom improvement. This approach provided a contrast to the results of subjective scale assessments [5]. However, it should be noted that this study still has limitations, such as a relatively small sample size and limited follow-up time, which are not conducive to physicians evaluating long-term efficacy [3]. In future in-depth studies on the treatment effects of cardial relaxation, scholars could increase the sample size and extend the follow-up time after endoscopic C-Blart to comprehensively evaluate surgical outcomes.

6.3. Study limitations and prospects

The data in this study verified the safety and efficacy of endoscopic C-Blart in treating patients with cardial relaxation, but there are still research limitations. For example, the small sample size of patients with cardial relaxation included in the study may affect statistical calculations, and there is no data to evaluate long-term efficacy [6]. Additionally, the follow-up time after endoscopic C-Blart was relatively short, and the long-term recurrence rate after surgery was not statistically analyzed. Furthermore, due to limitations in clinical research conditions, this study did not conduct stratified analysis of patients with different subtypes and still needs to explore further whether patients with severe esophageal hiatal hernia or Barrett's esophagus can undergo this surgical treatment [7]. Based on the analysis of the aforementioned study limitations, in future research, scholars could start from the following aspects: optimizing the surgical techniques for endoscopic C-Blart, improving the design of ligation devices and intraoperative operation methods to prevent and control postoperative complications as much as possible; increasing the sample size of patients with cardial relaxation and extending the postoperative follow-up time to evaluate the long-term efficacy and complication situation of this procedure; increasing the sample size of patients with cardial relaxation and conducting multi-center randomized controlled trials to analyze further the applicability of this procedure in different populations [6,7]. With the in-depth clinical research on endoscopic techniques, future treatments for patients with cardial relaxation could also explore the combined treatment of this procedure with radiofrequency therapy or fundoplication to further optimize treatment plans for cardial relaxation.

7. Conclusion

Endoscopic C-Blart is an emerging modern technique primarily used in the treatment of cardial relaxation and gastroesophageal reflux disease. This study designed a randomized controlled trial to evaluate patients' symptoms, objective examination indicators, and safety. The results showed that endoscopic C-Blart can alleviate symptoms such as heartburn and reflux, reduce the Gastroesophageal Reflux Disease

Questionnaire (GERDQ) score, and improve acid reflux parameters and the degree of esophageal mucosal lesions in patients [8,11]. The aforementioned data confirm the short-term efficacy of endoscopic C-Blart and provide data support for evaluating its long-term efficacy in patients.

From the perspective of safety, analyzing the feasibility of endoscopic C-Blart, patients with cardial relaxation in this study had fewer postoperative complications, and no serious complications were observed. These complications could be alleviated through conservative treatment interventions [6]. This suggests that endoscopic C-Blart is safe and feasible and represents a minimally invasive procedure with good development prospects. However, it should be noted that studies on the efficacy of endoscopic C-Blart still have limitations, including a small sample size and short follow-up periods, which may affect physicians' comprehensive evaluation of postoperative complications and long-term efficacy [7]. Therefore, in future research, scholars should expand the sample size, extend the postoperative follow-up period, and optimize the techniques for endoscopic C-Blart to enhance its efficacy.

Based on the data analysis in this study, endoscopic C-Blart is a safe and efficient treatment for patients with cardial relaxation and is suitable for patients who cannot tolerate long-term medication or for whom conventional drug therapy has been ineffective [2,3]. In subsequent related clinical practices, strict inclusion and exclusion criteria for patients with cardial relaxation should be established, and patients' individual health status should be evaluated. Additionally, surgical plans should be optimized by incorporating the opinions of multidisciplinary teams. Furthermore, to further optimize the efficacy of endoscopic C-Blart, large-scale, high-quality studies still need to be conducted in the future to clarify the long-term efficacy of the surgery, adjust the scope of surgical indications, and compare and analyze treatment advantages with other procedures [5,7].

In summary, endoscopic C-Blart is a safe and efficient treatment for patients with cardial relaxation. The data in this study can provide new treatment ideas for clinical practice, and this procedure should be reasonably used in the treatment of cardial relaxation in the future to optimize patient treatment outcomes.

Ethical statement

This study was approved by Ethics Committee of Jianhu County People's Hospital, (Ethics Review Approval Number: JY-LL-202401-K040).

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Disclosure statement

The authors declare no conflict of interest.

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