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Efficacy and safety of combined endoscopic rubber band ligation in the treatment of grade II-III prolapsed hemorrhoids: a retrospective study (with video)

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Background: Hemorrhoids is one of the most common anorectal diseases. In recent years, the incidence rate of hemorrhoids has been rising.

Aims: To investigate the efficacy and safety of combined endoscopic rubber band ligation (ERBL) in the treatment of grade II-III prolapsed internal hemorrhoids.

Methods: Patients with grade II-III prolapsed internal hemorrhoids treated from January 2019 to June 2023 were reviewed.

Results: Complete resolution was achieved in 124 cases (91.85%), partial resolution in 7 cases (5.19%), and recurrence in 4 cases (2.96%). 34 (25.19%) cases experienced anal pain after procedure, with a median visual analog scale (VAS) score of 0 (0–3). Postoperative bleeding occurred in 18 (13.33%) cases. Anal swelling was observed in 19 (14.07%) cases, and urinary retention occurred in 4 cases (2.96%). The incidence of postoperative pain (30.43% vs. 11.6%, $P = 0.018$) and VAS scores (0 vs. 0, $P = 0.003$) in the ligate three hemorrhoids group were significantly higher compared to the ligate two hemorrhoids group. There was no significant difference in long-term efficacy between the two groups. Male [odds ratio (OR) 5.654, 95% confidence interval (CI) 1.222–26.159; $P = 0.027$] and postoperative complications (OR 4.914, 95% CI 1.080–22.345; $P = 0.039$) were independent risk factors that were incomplete resolution.

Conclusions: Combined ERBL is an efficient and safe method for grade II-III prolapsed internal hemorrhoids. The number of hemorrhoids ligated had no significant effect on the long-term outcome, but the ligation of three hemorrhoids was associated with an increased incidence of postoperative pain. Male and postoperative complications are risk factors for incomplete resolution.

KEYWORDS

efficacy, endoscopic rubber band ligation, Endoscopy, Hemorrhoids, Internal hemorrhoids

Introduction

Hemorrhoids, as one of the most common anorectal diseases, account for approximately 98% of all anorectal diseases in China, with a prevalence rate of about 50% (1). Current interventions mainly include non-procedural (dietary and behavioral modifications and medical treatment), instrumental [rubber band ligation (RBL), sclerotherapy and infrared coagulation] and surgical treatments (2, 3). With the continuous development of endoscopic technology, endoscopic treatment of internal hemorrhoids has gradually become popular. Compared with traditional instrumental therapy under rigid proctoscopy, endoscopic therapy is more flexible and has a clearer field of view (4). In China, the endoscopic treatment for internal hemorrhoids is mainly endoscopic rubber band ligation (ERBL) and endoscopic sclerotherapy, of which ERBL is better than endoscopic sclerotherapy for patients with severe prolapse symptoms (5). ERBL has three location options of ligation: hemorrhoid ligation, hemorrhoid proximal mucosa ligation and hemorrhoid and proximal mucosa combined ligation (5). However, few studies have investigated the difference in efficacy between different ligation location, and the effect of the number of hemorrhoids to ligate and the number of bands used on the efficacy (6). Combined ligation is an effective method, but may increase the incidence of postoperative pain (7–9). It has been suggested to avoid ligating 3 hemorrhoids once to reduce postoperative discomfort, but one study suggested that increasing the number of ligation bands could increase the efficacy of grade III hemorrhoids (6, 10). In addition, identifying risk factors for incomplete resolution is critical to improving patient treatment strategies. This study aimed to evaluate the safety and efficacy of combined endoscopic rubber band ligation in the treatment of grade II–III prolapsed internal hemorrhoids, investigate the impact of the number of ligated hemorrhoids on therapeutic outcomes and complications, and identify risk factors for incomplete resolution.

Methods

Patients and data collection

Patients receiving endoscopic minimally invasive treatment for stage II and III hemorrhoids in the department of gastroenterology, the First Affiliated Hospital of Yichun University (People's Hospital of Wanzai County) from January 1, 2019 to June 30, 2023 were selected. According to the number of hemorrhoids were ligated, the patients were divided into ligate two hemorrhoids group and ligate three hemorrhoids group. The ligate two hemorrhoids group mainly consisted of patients from 2019 to 2022, and the patients after 2022 were basically ligated three hemorrhoids. Patients with complications (incarcerated hemorrhoids, thrombotic hemorrhoids, etc.), continuous use of anticoagulants, severe organ failure, anal fistula, coagulation

dysfunction, mental illness, pregnancy, and a history of colorectal malignancy or anorectal surgery were also excluded. This study was approved by the Ethics Committee of the First Affiliated Hospital of Yichun University (People's Hospital of Wanzai County) (No. 2025001) and was performed in accordance with the Declaration of Helsinki. Written informed consent form was waived.

Procedures

The entire procedure process employed gastroscopes (EG27-i10, EG2990i; HOYA Corporation, PENTAX Lifecare Division, Tokyo, Japan). Combined ERBL procedure: A 7 Shooter Saeed Multi-band Ligator (M00542251; Boston Scientific Corporation, Natick, MA, USA) was installed at the tip of the gastroscope. In the first step, the normal mucosa above the hemorrhoidal nucleus was ligated. The ligation point was approximately 3–4 cm above the dentate line. Under the inverted view, negative pressure aspiration was performed on the mucosa until the transparent cap was filled and the entire field of vision turned red, followed by the release of the ligation ring by rotating the handle of the ligation device. In the second step, the hemorrhoidal nucleus was ligated under the direct view, and the ligation point was approximately 1 cm above the dentate line. Postoperatively, patients were prescribed a liquid diet based on the physician's experience. In the event that patients experienced discomfort in the anal area, they were advised to take warm sitz baths. If the bleeding did not stop spontaneously, anti-inflammatory and hemostatic ointments were applied topically for cases with a small amount of bleeding, and secondary endoscopic treatment or surgical intervention was contemplated for cases with a large amount of bleeding. If they had intolerable pain, analgesics (aubucaine gel) were prescribed for external use. If patients developed urinary retention, local hot compresses were provided for mild cases, and catheterization was carried out for severe cases. If patients developed thrombotic external hemorrhoids, anti-inflammatory and analgesic ointments were applied topically for mild pain cases, and surgical intervention was considered as appropriate for severe cases.

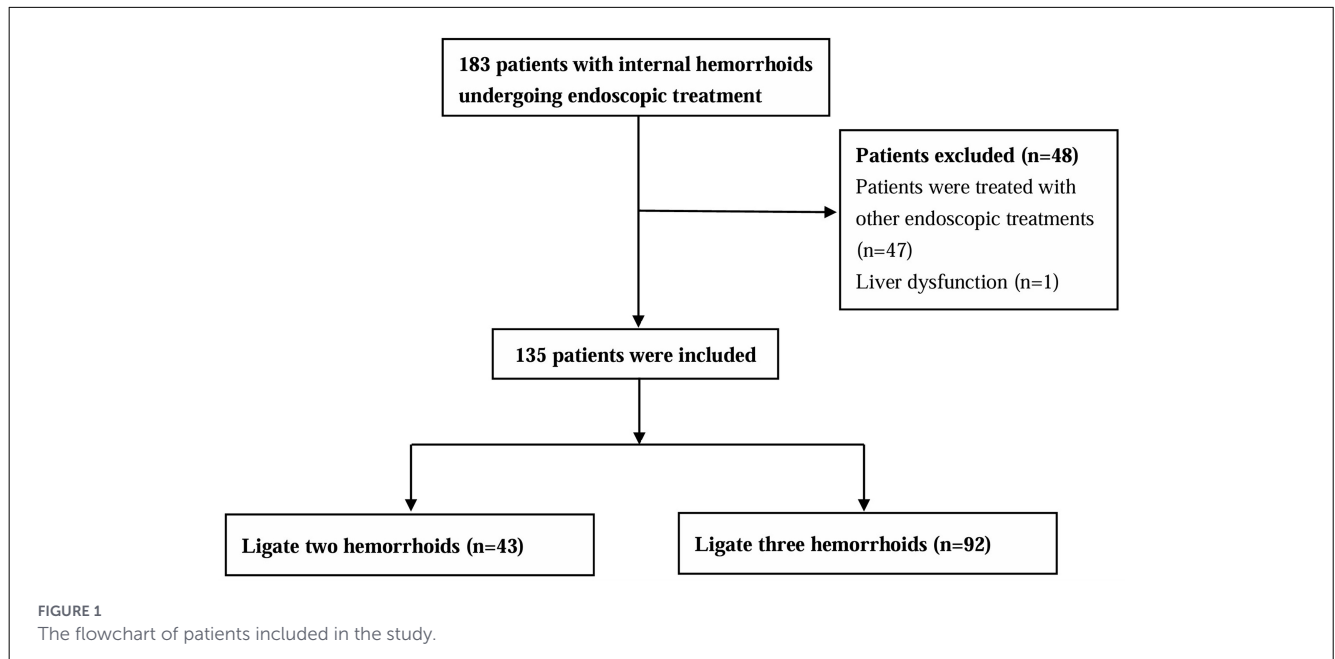
Evaluations before and after the procedure

The bleeding score, hemorrhoid disease symptom score (HDSS), and quality of life score were used to evaluate the severity of preoperative symptoms (11). During the postoperative hospital stay, complications within 1 week after the operation were observed to evaluate the safety of the procedure. Postoperative pain was assessed using the visual analog scale (VAS).

Long-term follow-up and outcome assessment

The long-term effect, recurrence of hemorrhoids and improvement of postoperative complications were observed through outpatient or telephone follow-up. There are three levels of efficacy: (1) Complete resolution: the patient's symptoms

Abbreviations: RBL, Rubber band ligation; ERBL, Endoscopic rubber band ligation; HDSS, Hemorrhoid disease symptom score; VAS, Visual analog scale; OR, Odds ratio; CI, Confidence interval.



disappear completely; (2) Partial resolution: symptoms improve from before treatment; and (3) Ineffective: symptoms do not improve or worsen. Partial resolution and inefficiencies are considered incomplete resolution. HDSS and quality of life score were used to evaluate the severity of symptoms.

Statistical analysis

Data are expressed by number (*n*) or rate (%). Data with normal distribution were expressed as mean \pm standard deviation ($\bar{x} \pm s$), and those with abnormal distribution were expressed as median and interquartile range. Quantitative variables were compared using the independent *t* test or Mann–Whitney U test between two groups. Chi-square test or Fisher exact test were used for the comparisons of qualitative variables. Univariate and multivariate logistic regression analysis were used to investigate the risk factors of incomplete resolution.

SPSS Statistics (version 23.0; IBM, Armonk, New York, USA) was utilized for data analysis. A value of $P < 0.05$ was considered statistically significant.

Results

Characteristics and outcomes of the total patients

A total of 135 patients were enrolled after screening according to inclusion and exclusion criteria, and all patients completed follow-up (Figure 1). The mean age of all patients at baseline was 53.12 ± 10.71 years, including 46 males (34.1%) and 89 females (65.9%). The mean BMI was 23.45 ± 3.39 kg/m². All patients had prolapsed symptoms, 34 (25.2%) with bleeding, 8 (5.9%) with pain, and 66 (48.89%) with pruritus. 69 (51.11%) were diagnosed

TABLE 1 Clinical characteristics of the total cohort.

Characteristic	Combined ERBL group (N = 135)
Gender (n) (%)	
Male	46 (34.07)
Female	89 (65.93)
Age (years) (mean \pm SD)	53.12 \pm 10.71
BMI (kg/m ²) (mean \pm SD)	23.45 \pm 3.39
Goligher grade (n) (%)	
II	69 (51.11)
III	66 (48.89)
Symptom (n) (%)	
Prolapse	135 (100)
Bleeding	34 (25.19)
Pain	8 (5.93)
Anal pruritus	9 (6.67)
Bleeding score, median (IQR)	0 (0–2)
Hemorrhoidal disease symptom score, median (IQR)	3 (3–5)
Quality of life score, median (IQR)	2 (1–3)

with Goligher grade II and 66 (48.89%) with Goligher grade III. None of the patients had undergone colorectal surgery before. The median bleeding score was 0 (0–2), the median hemorrhoid symptom score was 3 (3–5), and the median quality of life score was 2 (1–3) (Table 1). Figure 2 shows an example of endoscopic images before and after combined ERBL treatment. Within 7 days after ERBL procedure, 34 (25.19%) cases experienced anal pain, with a median VAS score of 0 (0–3). Analgesics were required in

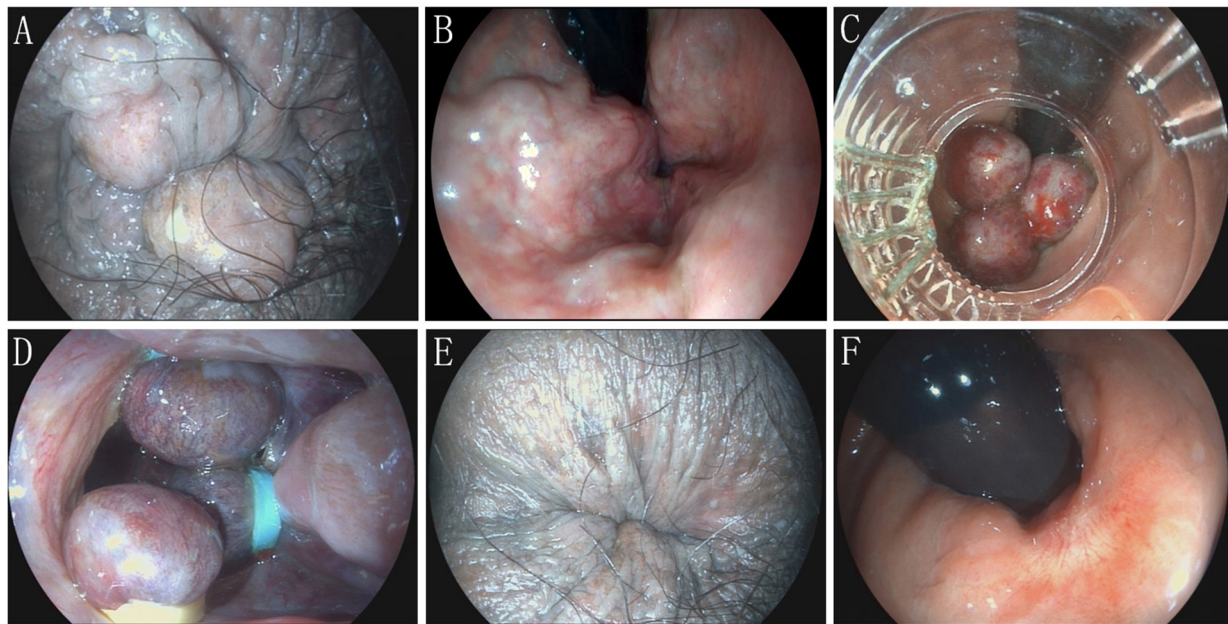


FIGURE 2

Combined endoscopic rubber band ligation in the treatment of a patient with grade III internal hemorrhoids. **A.** Preoperative external anal manifestations; **B.** Preoperative anal canal manifestations; **C.** Ligation of normal mucosa at the proximal end of hemorrhoids; **D.** Ligation of three hemorrhoids; **E.** Postoperative external anal manifestations; **F.** Anal canal manifestations 6 months after the procedure.

25 (18.52%) cases. Postoperative bleeding occurred in 18 (13.33%) cases, none of which necessitated endoscopic therapy. Anal swelling was observed in 19 (14.07%) cases, and urinary retention occurred in 4 cases (2.96%). During long-term follow-up spanning a median of 29 (12–34) months, complete resolution was achieved in 124 cases (91.85%), partial resolution in 7 cases (5.19%), and recurrence in 4 cases (2.96%) (Table 2).

Comparison between the two groups

The patients were divided into ligate two hemorrhoids group ($N = 43$) and ligate three hemorrhoids group ($N = 92$). There were no significant differences in baseline information between the two groups (Table 3). The incidence of postoperative pain (11.6% vs. 30.43%, respectively; $P = 0.018$) and VAS scores [0 (0–1) vs. 0 (0–3.75), respectively; $P = 0.003$] in the ligate three hemorrhoids group were significantly higher compared to the ligate two hemorrhoids group. The analgesic usage rate in the ligate three hemorrhoids group was higher than that in the ligate two hemorrhoids group, but the difference was not statistically significant (9.30% vs. 22.83%, respectively; $P = 0.059$). There were no significant differences in the incidence of postoperative bleeding (13.95% vs. 13.04%, respectively; $P = 0.885$), urinary retention (2.32% vs. 3.26%, respectively; $P = 1.000$) and anal swelling (13.95% vs. 14.13%, respectively; $P = 0.978$) between the two groups. Hemorrhoidal disease symptom score [0 (0–0) vs. 0 (0–0), $P = 0.334$] and quality of life score [0 (0–0) vs. 0 (0–0), $P = 0.355$] had no significant difference between the two groups. There was no significant difference in the long-term outcomes between the two groups ($P = 0.427$). In the 2 hemorrhoids ligated group, 1 patient

received re-treatment, and in the 3 hemorrhoids ligated group, 4 patients received re-treatment. There was no significant difference in the re-treatment rate (2.33% vs. 4.35%, $P = 0.566$) (Table 4).

Risk factors for predict the incomplete resolution

Univariate and multivariate regression analyses found that male [odds ratio (OR) 5.654, 95% confidence interval (CI) 1.222–26.159; $P = 0.027$] and short-term postoperative complications [OR 4.914, 95% (CI) 1.080–22.345; $P = 0.039$] were independent risk factors that were incomplete resolution (Table 5).

Discussion

The pathogenesis of hemorrhoids is not clear at present, the mainstream view is the abnormal sliding of the anal pad in the anal canal (35, 36). Different ideas about the pathogenesis of hemorrhoids have led to different surgical methods (36). In order to reduce the burden on patients, non-surgical treatment is generally used for low-grade hemorrhoids, and surgical treatment is chosen when high-grade hemorrhoids or non-surgical treatment fails (37). In recent years, the purpose of treating hemorrhoids has changed from completely eliminating hemorrhoids to eliminating symptoms (5, 38). Although surgical treatment is more effective than non-surgical treatment, it comes at the cost of more pain and complications (12–14, 39). For grade I–III internal hemorrhoids, office management may be more cost-effective. Sclerotherapy and

TABLE 2 Postoperative complications and long-term outcomes of the total cohort.

Characteristic	Combined ERBL group (N = 135)
Postoperative complications (<7 days)	
Postoperative pain (n) (%)	
Yes	34 (25.19)
No	101 (74.81)
Pain VAS, median (IQR)	0 (0–3)
Analgesic requirement (n) (%)	
Yes	25 (18.52)
No	110 (81.48)
Postoperative bleeding (n) (%)	
Yes	18 (13.33)
No	117 (86.67)
Urinary retention (n) (%)	
Yes	4 (2.96)
No	131 (97.04)
Anal swelling (n) (%)	
Yes	19 (14.07)
No	116 (85.93)
Long-term outcomes	
Hemorrhoidal disease symptom score, median (IQR)	0 (0–0)
Quality of life score, median (IQR)	0 (0–0)
Procedure outcomes (n) (%)	
Complete resolution	124 (91.85)
Partial resolution	7 (5.19)
Ineffective	4 (2.96)
Retreatment	5 (3.70)

RBL are the most common office therapies in China. Sclerotherapy is more convenient to operate, and the incidence of pain is lower than RBL, but RBL is more effective than sclerotherapy (9, 15–17). For patients with hemorrhoids whose main symptom is prolapse, RBL may be a better option (18).

The main principle of RBL is to promote rectal mucosal fibrosis and reduce blood flow to hemorrhoids to prevent prolapse and bleeding (19). RBL performed under proctoscopy can only provide a limited field of view and it is difficult to perform multiple ligations at once. ERBL is flexible and visualized in operation, avoiding blind ligation. Moreover, it is convenient to perform multiple ligations with the ligation device used for treating gastroesophageal varices. A randomized controlled trial found that RBL and ERBL had similar efficacy and safety, but ERBL required fewer treatment sessions (20). The ligation site in ERBL is typically selected at either the hemorrhoids or the normal rectal mucosa proximal to the hemorrhoids. The combined ERBL technique simultaneously ligates both the normal rectal mucosa proximal to hemorrhoids

TABLE 3 Clinical characteristics of the two groups.

Characteristic	Ligate 2 hemorrhoids (N = 43)	Ligate 3 hemorrhoids (N = 92)	P value
Gender (n) (%)			
Male	13 (30.23)	33 (35.87)	0.520
Female	30 (69.77)	59 (64.13)	
Age (years) (mean ± SD)	53.65 ± 10.75	52.88 ± 10.74	0.698
BMI	22.98 ± 3.60	23.67 ± 3.28	0.274
Goligher grade (n) (%)			
II	25 (58.14)	44 (47.83)	0.264
III	18 (41.86)	48 (52.17)	
Hemorrhoidal disease symptom score, median (IQR)	3 (3–5)	3 (3–5)	0.574
Bleeding score, median (IQR)	0 (0–2)	0 (0–0)	0.930
Quality of life score, median (IQR)	1 (1, 2)	2 (1–3)	0.175

and the hemorrhoids themselves, aiming to enhance therapeutic efficacy for prolapse.

In this study, the complete resolution rate reached 91.85%, which was close to the previous studies (7, 8). During the long-term follow-up, the symptoms of 124 patients were completely relieved, the symptoms of 7 patients partially improved, and the symptoms of 4 patients did not improve or recurred. Five patients underwent retreatment within 1 to 6 months after the procedure. Among them, 4 patients underwent endoscopic treatment again and 1 patient underwent operative treatment.

In terms of safety, common complications of ERBL include bleeding, thrombosis of external hemorrhoids, anal discomfort and urinary retention. Severe complications include massive hemorrhage, pelvic sepsis, liver abscess, etc. Massive bleeding is generally considered to be caused by premature detachment of the ligation band or the patient's recent use of anticoagulants (21–23). Pelvic sepsis and liver abscess have been reported in cases treated with RBL, but not in cases with ERBL (24–27). In this study, no patients had severe postoperative complications, and all postoperative complications were relieved during the hospital observation period. The total incidence of postoperative pain was 25.19%. Two previous randomized controlled studies respectively found that 74.2% and 27% of patients with combined ERBL experienced postoperative pain. The difference in the data might be due to the different criteria for judging postoperative pain in different studies (7, 8). Twenty-five patients (18.52%) who could not tolerate anal discomfort all had their pain relieved after being given analgesic. Eighteen patients (13.33%) had mild bleeding within 7 days after the procedure, and no endoscopic hemostasis

TABLE 4 Postoperative complications and long-term outcomes of the two groups.

Characteristic	Ligate 2 hemorrhoids (N = 43)	Ligate 3 hemorrhoids (N = 92)	P value
Postoperative complications (< 7 days)			
Postoperative pain (n) (%)			
Yes	5 (11.63)	28 (30.43)	0.018
No	38 (88.37)	64 (69.57)	
Pain VAS, median (IQR)	0 (0–1)	0 (0–3.75)	0.003
Analgesic requirement (n) (%)			
Yes	4 (9.30)	21 (22.83)	0.059
No	39 (90.70)	71 (77.17)	
Postoperative bleeding (n) (%)			
Yes	6 (13.95)	12 (13.04)	0.885
No	37 (86.05)	80 (86.96)	
Urinary retention (n) (%)			
Yes	1 (2.32)	3 (3.26)	1.000
No	42 (97.67)	89 (96.74)	
Anal swelling (n) (%)			
Yes	6 (13.95)	13 (14.13)	0.978
No	37 (86.05)	79 (85.87)	
Long-term outcomes (> 12 months)			
Hemorrhoidal disease symptom score, median (IQR)	0 (0–0)	0 (0–0)	0.334
Quality of life score, median (IQR)	0 (0–0)	0 (0–0)	0.355
Procedure outcomes (n) (%)			
Complete resolution	40 (93.02)	84 (91.30)	0.427
Partial resolution	1 (2.33)	6 (6.52)	
Recurrence	2 (4.65)	2 (2.17)	
Retreatment	1 (2.33)	4 (4.35)	0.566

was required. Urinary retention occurred in 4 patients (8.1%), and their urinary function recovered within 3 days after hot compress.

There is no unified standard or consensus for the number of bands used and the number of hemorrhoids to ligate in a single session of ERL. The guidelines in China only recommend that no more than 7 ligation bands be used in a single session, for grade I-II internal hemorrhoids, it is advisable to avoid banding all hemorrhoids simultaneously (5). Some suggest that a single treatment should avoid banding three hemorrhoids simultaneously. However, other studies have found that ligating three hemorrhoids at once can shorten the treatment process and the complications are acceptable (10, 28–30). This study found that the incidence of pain and VAS score in the ligate three

TABLE 5 Risk factors for predict the incomplete resolution.

Factors (n)	Univariable analysis OR (95%CI), P value	Multivariable analysis aOR (95%CI), P value
Gender (n)		
Female (7)	1 (Reference)	1 (Reference)
Male (4)	3.675 (1.017–13.282), 0.047	5.654 (1.222–26.159), 0.027
Age (years)	0.969 (0.914–1.028), 0.299	0.962 (0.900–1.027), 0.243
BMI	0.939 (0.776–1.138), 0.522	0.905 (0.744–1.102), 0.321
Goligher grade		
II (7)	1 (Reference)	1 (Reference)
III (6)	0.750 (0.293–1.918), 0.548	1.453 (0.139–15.232), 0.755
Ligate hemorrhoids		
2 hemorrhoids (3)	1 (Reference)	1 (Reference)
3 hemorrhoids (8)	1.280 (0.371–4.414), 0.696	1.494 (0.283–7.889), 0.636
Hemorrhoidal disease symptom score	0.933 (0.596–1.459), 0.760	0.252 (0.014–3.071), 0.252
Bleeding score	1.184 (0.871–1.609), 0.280	2.781 (0.570–13.562), 0.206
Quality of life score	1.187 (0.652–2.163), 0.575	1.049 (0.103–10.653), 0.968
Postoperative complications		
No (3)	1 (Reference)	1 (Reference)
Yes (8)	3.692 (0.934–14.589), 0.062	4.914 (1.080–22.345), 0.039

hemorrhoids group were significantly higher than those in the ligate two hemorrhoids group. The analgesic requirement rate in the ligate three hemorrhoids group (22.83%) was higher than that in the ligate two hemorrhoids group (9.30%), but the difference was not significant. This might be because ligating three hemorrhoids requires more ligation bands, increasing the discomfort of patients (31). Long-term follow-up found no significant difference in efficacy between the two groups, suggesting that combined ERL may not require to ligate three hemorrhoids once.

Multivariate regression analysis revealed that male gender and postoperative complications were independent risk factors leading to incomplete resolution. One study has found that male gender is significantly associated with the severity and

recurrence of hemorrhoids, other studies have found that male gender is a risk factor for delayed bleeding and readmissions after hemorrhoidectomy, which may be attributed to their higher levels of physical activity (32–34, 40). We found that short-term complications after procedure are also independent risk factors for incomplete resolution. Some of the bleeding may be due to incomplete ligation, and bleeding and anal discomfort may cause patients to be reluctant to defecate, leading to constipation and thereby increasing the risk of recurrence of hemorrhoids (32).

The study still has several limitations. Firstly, this is a single-center retrospective study, information bias is unavoidable. In particular, treatment assignments were nonrandomized and subject to potential historical bias. However, in this study, the group expected to have more mature techniques (the group with three hemorrhoids ligation) had a significantly higher incidence of pain and VAS score, and there was no significant difference in long-term efficacy. Therefore, the increase in ligation bands may be a more direct cause of postoperative complications rather than the learning curve of endoscopists. This bias has a limited impact on the results. However, prospective randomized studies are needed to overcome this limitation in the future. Secondly, as a retrospective study, a formal sample size calculation was not performed prior to data collection. However, the sample size of 135 patients is comparable to or larger than that of several previously published studies on combined ERBL (7, 8), suggesting adequate power for the primary analyses of efficacy and safety. In addition, it should be noted that the sample size for incomplete resolution was small and the statistical power of the regression analysis was limited. Therefore, the results for risk factors should be interpreted with caution, mainly to provide hypotheses for future prospective studies with larger samples.

Conclusion

In conclusion, combined endoscopic rubber band ligation is an efficient and safe method for grade II-III internal hemorrhoids with prolapse as the main symptom. The number of hemorrhoids ligation had no significant effect on the outcome, but ligation of only two hemorrhoids reduced postoperative pain. Male and postoperative complications were identified as significant risk factors for incomplete resolution. Close follow-up monitoring of these high-risk patients is recommended to facilitate timely retreatment when necessary.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by the Ethics Committee of the First Affiliated Hospital of Yichun University

(People's Hospital of Wanzai County) (No. 2025001)) and followed the principles of the Declaration of Helsinki. The studies were conducted in accordance with the local legislation and institutional requirements. The ethics committee waived the requirement of written informed consent for participation from the participants or the participants' legal guardians/next of kin because this was a retrospective study and only hospital medical record data were used.

Author contributions

TC: Writing – original draft, Writing – review & editing, Resources, Software, Visualization. GC: Data curation, Writing – original draft. MZ: Formal analysis, Project administration, Writing – original draft. FL: Data curation, Investigation, Methodology, Writing – original draft. JA: Project administration, Supervision, Writing – review & editing. FG: Data curation, Project administration, Supervision, Writing – original draft. HS: Data curation, Writing – original draft, Investigation, Software. YZ: Data curation, Writing – original draft. XS: Methodology, Supervision, Validation, Writing – review & editing. HC: Data curation, Funding acquisition, Writing – review & editing, Project administration, Resources, Supervision.

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Conflict of interest

The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fmed.2026.1755971/full#supplementary-material>

References

- Chen P, Han B, Zhou L, Chen G, Li S, Yan H. Effects of work-related factors on anorectal diseases in adult residents in China. *Chin J Public Health*. (2017) 33:1628–31. doi: 10.11847/zgggws2017-33-11-22
- Hawkins AT, Davis BR, Bhama AR, Fang SH, Dawes AJ, Feingold DL, et al. Clinical practice guidelines committee of the American society of colon and rectal surgeons. The American society of colon and rectal surgeons clinical practice guidelines for the management of hemorrhoids. *Dis Colon Rectum*. (2024) 67:614–23. doi: 10.1097/DCR.0000000000003276
- Li J, Chen Y, Liao S, Lin D, MingliSu, Hu J, et al. Rubber band ligation or shaobei injection for the endoscopic treatment of symptomatic hemorrhoids? A retrospective study. *Surg Endosc*. (2025) 39:1555–64. doi: 10.1007/s00464-024-11491-6
- Su M-Y, Chiu C-T, Lin W-P, Hsu C-M, Chen P-C. Long-term outcome and efficacy of endoscopic hemorrhoid ligation for symptomatic internal hemorrhoids. *World J Gastroenterol*. (2011) 17:2431–6. doi: 10.3748/wjg.v17.i19.2431
- Internal hemorrhoids cooperative group of chinese society of digestive endoscopy. Chinese digestive endoscopic practice guide lines and operation consensus for internal hemorrhoids (2021). *Chin J Dig Endosc*. (2021) 38:676–87. doi: 10.3760/cma.j.cn321463-20210526-00340
- Xiong K, Zhao Q, Li W, Yao T, Su Y, Wang J, et al. Comparison of the long-term efficacy and safety of multiple endoscopic rubber band ligations in a single session for varying grades of internal hemorrhoids. *Ir J Med Sci*. (2023) 192:2747–53. doi: 10.1007/s11845-023-03367-w
- Fukuda A, Kajiyama T, Arakawa H, Kishimoto H, Someda H, Sakai M, et al. Retroflexed endoscopic multiple band ligation of symptomatic internal hemorrhoids. *Gastrointest Endosc*. (2004) 59:380–4. doi: 10.1016/S0016-5107(03)02818-9
- Tian L, Yu C, Qin Y, Gong Y, Cheng W. Efficacy of two endoscopic rubber band ligation methods for symptomatic hemorrhoids: a randomized controlled trial. *Surg Endosc*. (2023) 37:6235–45. doi: 10.1007/s00464-023-10108-8
- MacRae HM, McLeod RS. Comparison of hemorrhoidal treatment modalities. A meta-analysis. *Dis Colon Rectum*. (1995) 38:687–94. doi: 10.1007/BF02048023
- Qureshi W. Top tips for successful endoscopic hemorrhoid banding (with video). *Gastrointest Endosc*. (2024) 99:437–8. doi: 10.1016/j.gie.2023.11.054
- Rørvik HD, Styr K, Ilum L, McKinstry GL, Dragesund T, Campos AH, et al. Hemorrhoidal disease symptom score and short health ScaleHD: new tools to evaluate symptoms and health-related quality of life in hemorrhoidal disease. *Dis Colon Rectum*. (2019) 62:333–42. doi: 10.1097/DCR.0000000000001234
- Dekker L, Han-Geurts IJM, Rørvik HD, van Dieren S, Bemelman WA. Rubber band ligation versus haemorrhoidectomy for the treatment of grade II-III haemorrhoids: a systematic review and meta-analysis of randomised controlled trials. *Tech Coloproctol*. (2021) 25:663–74. doi: 10.1007/s10151-021-02430-x
- Yano T, Asano M, Tanaka S, Oda N, Matsuda Y. Prospective study comparing the new sclerotherapy and hemorrhoidectomy in terms of therapeutic outcomes at 4 years after the treatment. *Surg Today*. (2014) 44:449–53. doi: 10.1007/s00595-013-0564-y
- Brown SR, Tiernan JP, Watson AJM, Biggs K, Shephard N, Wailoo AJ, et al. HubBLE Study team. Haemorrhoidal artery ligation versus rubber band ligation for the management of symptomatic second-degree and third-degree haemorrhoids (HubBLE): a multicentre, open-label, randomised controlled trial. *Lancet*. (2016) 388:356–64. doi: 10.1016/S0140-6736(16)30584-0
- MacRae HM, McLeod RS. Comparison of hemorrhoidal treatments: a meta-analysis. *Can J Surg*. (1997) 40:14–7.
- Salgueiro P, Ramos MI, Castro-Poças F, Libânio D. Office-based procedures in the management of hemorrhoidal disease: rubber band ligation versus sclerotherapy - systematic review and meta-analysis. *GE Port J Gastroenterol*. (2022) 29:409–19. doi: 10.1159/000522171
- Keong SYJ, Tan HK, Lamawansa MD, Allen JC, Low ZL, Østbye T. Improvement in quality of life among Sri Lankan patients with haemorrhoids after invasive treatment: a longitudinal observational study. *BJS Open* (2021) 5:zrab014. doi: 10.1093/bjsopen/zrab014
- Yu J, Zhong J, Peng T, Jin L, Shen L, Yang M. Modified rubber band ligation for treatment of grade II/III hemorrhoids: clinical efficacy and safety evaluation-a retrospective study. *BMC Surg*. (2022) 22:238. doi: 10.1186/s12893-022-01688-8
- Qureshi WA. Office management of hemorrhoids. *Am J Gastroenterol*. (2018) 113:795–8. doi: 10.1038/s41395-018-0020-0
- Wehrmann T, Riphaut A, Feinstein J, Stergiou N. Hemorrhoidal elastic band ligation with flexible videoendoscopes: a prospective, randomized comparison with the conventional technique that uses rigid proctoscopes. *Gastrointest Endosc*. (2004) 60:191–5. doi: 10.1016/S0016-5107(04)01551-2
- Albuquerque A. Rubber band ligation of hemorrhoids: a guide for complications. *World J Gastrointest Surg*. (2016) 8:614–20. doi: 10.4240/wjgs.v8.i9.614
- Jiang YD, Liu Y, Wu JD, Li GP, Liu J, Hou XH, et al. Massive gastrointestinal bleeding after endoscopic rubber band ligation of internal hemorrhoids: a case report. *World J Clin Cases*. (2022) 10:6656–63. doi: 10.12998/wjcc.v10.i19.6656
- Bat L, Melzer E, Koler M, Dreznick Z, Shemesh E. Complications of rubber band ligation of symptomatic internal hemorrhoids. *Dis Colon Rectum*. (1993) 36:287–90. doi: 10.1007/BF02053512
- Parker R, Gul R, Bucknall V, Bowley D, Karandikar S. Double jeopardy: pyogenic liver abscess and massive secondary rectal haemorrhage after rubber band ligation of haemorrhoids. *Colorectal Dis*. (2011) 13:e184. doi: 10.1111/j.1463-1318.2010.02387.x
- Wechter DG, Luna GK. An unusual complication of rubber band ligation of hemorrhoids. *Dis Colon Rectum*. (1987) 30:137–40. doi: 10.1007/BF02554954
- Shemesh EI, Kodner JJ, Fry RD, Neufeld DM. Severe complication of rubber band ligation of internal hemorrhoids. *Dis Colon Rectum*. (1987) 30:199–200. doi: 10.1007/BF02554339
- Ergas D, Abdul-Hai A, Sthoeger Z, Menahem B-H, Miller R. Multiple pyogenic liver abscesses following hemorrhoid banding. *Isr Med Assoc J*. (2007) 9:753–4.
- Sneider EB, Maykel JA. Diagnosis and management of symptomatic hemorrhoids. *Surg Clin North Am*. (2010) 90:17–32, Table of Contents. doi: 10.1016/j.suc.2009.10.005
- Davis KG, Pelta AE, Armstrong DN. Combined colonoscopy and three-quadrant hemorrhoidal ligation: 500 consecutive cases. *Dis Colon Rectum*. (2007) 50:1445–9. doi: 10.1007/s10350-007-0273-y
- Lee HH, Spencer RJ, Beart RW. Multiple hemorrhoidal bandings in a single session. *Dis Colon Rectum*. (1994) 37:37–41. doi: 10.1007/BF02047212
- Komporozos V, Ziozia V, Komporozou A, Stravodimos G, Kolinioti A, Papazoglou A. Rubber band ligation of symptomatic hemorrhoids: an old solution to an everyday problem. *Int J Colorectal Dis*. (2021) 36:1723–9. doi: 10.1007/s00384-021-03900-2
- Godeberge P, Sheikh P, Zagriadskii E, Lohsiriwat V, Montaño AJ, Košorok P, et al. Hemorrhoidal disease and chronic venous insufficiency: Concomitance or coincidence; results of the CHORUS study (Chronic venous and HemORrhoidal diseases evaluation and Scientific research). *J Gastroenterol Hepatol*. (2020) 35:577–85. doi: 10.1111/jgh.14857
- Cheng K-C, Song L-C, Wu K-L, Chen H-H, Lee K-C. Risk factors of delayed hemorrhage after LigaSure hemorrhoidectomy. *BMC Surg*. (2022) 22:361. doi: 10.1186/s12893-022-01802-w

34. Xia W, MacFater WS, Barazanchi AWH, Sammour T, Hill AG. Risk factors associated with unplanned readmission following excisional haemorrhoidectomy. *Colorectal Dis.* (2020) 22:187–94. doi: 10.1111/codi.14852
35. Thomson WH. The nature of haemorrhoids. *Br J Surg.* (1975) 62:542–52. doi: 10.1002/bjs.1800620710
36. Lohsiriwat V. Hemorrhoids: from basic pathophysiology to clinical management. *World J Gastroenterol.* (2012) 18:2009–17. doi: 10.3748/wjg.v18.i17.2009
37. Lohsiriwat V. Treatment of hemorrhoids: a coloproctologist's view. *World J Gastroenterol.* (2015) 21:9245–52. doi: 10.3748/wjg.v21.i31.9245
38. van Tol RR, Kleijnen J, Watson AJM, Jongen J, Altomare DF, Qvist N, et al. European society of coloproctology: guideline for haemorrhoidal disease. *Colorectal Dis.* (2020) 22:650–62. doi: 10.1111/codi.14975
39. Dekker L, Bak MTJ, Bemelman WA, Felt-Bersma RJF, Han-Geurts IJM. Hemorrhoidectomy versus rubber band ligation in grade III hemorrhoidal disease: a large retrospective cohort study with long-term follow-up. *Ann Coloproctol.* (2022) 38:146–52. doi: 10.3393/ac.2020.01011.0144
40. Jeong HY, Hwang D-Y, Cho DH, Lee JK. Analysis of risk factors for delayed bleeding after semi-closed hemorrhoidectomy. *Int J Colorectal Dis.* (2021) 36:857–64. doi: 10.1007/s00384-021-03895-w