

Review Article

## Minimally Invasive Treatment for Advanced Hemorrhoids

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### Abstract

Hemorrhoids, the most common anorectal disease, give rise to symptoms such as bleeding, prolapse, and pruritus. The treatment for advanced hemorrhoids (Grade III or IV) is gradually shifting toward minimally invasive procedures. These procedures focus on reduction of blood flow in hemorrhoids. Conventional hemorrhoidectomy (CH), also known as Milligan-Morgan or Ferguson hemorrhoidectomy, is considered as the standard treatment for Grade III and IV hemorrhoids because it achieves the lowest recurrence rate. Over the years, alternative minimally invasive techniques such as stapled hemorrhoidopexy and transanal hemorrhoidal dearterialization (THD) have been developed. A new, effective sclerosant, aluminum potassium sulfate and tannic acid (ALTA), has been developed in Japan and has been used for all grades of hemorrhoids; however, its effectiveness declines over time. Other minimally invasive, nonsurgical procedures, including rubber band ligation, endoscopic injection sclerotherapy, and infrared coagulation, have also been performed for Grade III hemorrhoids. Those minimally invasive treatments improve bleeding and prolapse and are highly recommended for patients who are unfit for CH. THD with mucopexy or ALTA sclerotherapy has also been performed for Grade IV hemorrhoids. However, the recurrence rate after ALTA sclerotherapy for Grade IV hemorrhoids was higher than that for Grade III lesions in our case study. In conclusion, minimally invasive treatments are a valid alternative for patients with advanced hemorrhoids after clear explanation of recurrence rates and possible complications.

### Keywords

advanced hemorrhoid, minimally invasive treatment, aluminum potassium sulfate and tannic acid sclerotherapy, hemorrhoidectomy

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### 1. Introduction

Hemorrhoids are the most common anorectal disease worldwide. The term “hemorrhoidal disease” can be employed when hemorrhoidal tissue gives rise to symptoms such as bleeding, prolapse, or pruritus [1]. There are multiple causative factors; these include prolonged straining, irregular bowel habits, and inherited factors. As a result of degeneration of supporting connective tissue, hemorrhoidal cushions slide.

Hemorrhoidal vascularization also appears to play a cen-

tral role in the pathophysiology of hemorrhoidal disease. Hyperplasia of the arteriovenous network within the anorectal submucosa—the corpus cavernosum recti—results in increased vascular pressure.

Conservative treatment based on dietary and lifestyle changes can help patients with all Goligher grades of hemorrhoids. However, when symptoms are serious, surgical treatment is required. In particular, surgical treatment is required for the most advanced stages, Grades III and IV [2]. Currently, there are several surgical procedures for treating advanced hemorrhoids, such as conventional hemorrhoidec-

tomy (CH), stapled hemorrhoidopexy (SH), transanal hemorrhoidal dearterialization (THD), and Doppler-guided hemorrhoidal arterial ligation (DGHAL) with rectoanal repair [1-4]. Patients with Grade III or IV hemorrhoids have traditionally undergone CH. However, CH requires excision of both the internal and external hemorrhoid cushions, resulting in considerable pain during the postoperative recovery period [5]. Surgical procedures such as SH, THD, and DGHAL with rectoanal repair result in less postoperative pain because the anoderm is preserved with these procedures.

In contrast, injection sclerotherapy has become a popular modality of treatment for all grades of internal hemorrhoids in patients in varying conditions and with various comorbidities [6]. In Japan, sclerotherapy using the Japanese sclerosant aluminum potassium sulfate and tannic acid (ALTA) is popular and effective for Grade II, III, and IV hemorrhoids [7]; however, its effectiveness declines over time. Other nonsurgical treatments, including rubber band ligation (RBL), injection sclerotherapy rather than ALTA sclerotherapy, and infrared coagulation (IRC), have also been performed for Grade III hemorrhoids [8].

Minimally invasive treatments are an alternative means of treating symptomatic patients with advanced hemorrhoids. The aim of this review was to show the effectiveness of ALTA sclerotherapy, including results of our case study, and to provide a framework for selecting the best procedure for each patient, namely, the procedure with the lowest recurrence rate and fewest complications.

## 2. Treatment Options for Advanced Hemorrhoids

In this review, minimally invasive techniques for advanced hemorrhoidal disease, including SH, THD, DGHAL, THD with mucopexy, three types of sclerotherapy, ACL, RBL, and IRC, are discussed. The three types of sclerotherapy are ALTA, phenol almond oil (PAO), and endoscopic injection sclerotherapy (EIS), including Cap-assisted endoscopic sclerotherapy (CAES).

### 2.1. SH

In this procedure, a circular stapling device is used to excise a ring of redundant rectal mucosa proximal to the hemorrhoids, after which the hemorrhoids are resuspended within the anal canal [9]. In this procedure, the sensitive epithelium of the hemorrhoids is not damaged [9]. Burch et al. reported that, compared with CH, SH results in less postoperative pain and shorter operating time, hospital stay, and convalescence; however, there is a high rate of prolapse requiring reintervention [10].

Owing to the risk of serious complications, this procedure should only be performed by well-trained surgeons and only for circumferential Grade III hemorrhoids when associated

with an internal mucosal rectal prolapse.

### 2.2. THD and DGHAL with mucopexy

DGHAL was originally indicated for Grade II hemorrhoids and had encouraging short-term results with low rates of postoperative morbidity at 30 days [11]. A further development of this technique enabled the addition of a mucopexy through a modified anoscope, making it possible both to reduce the blood flow to the anal cushions and to lift and fix them high in the anal canal. This new procedure, termed THD, has successfully been performed for Grade III hemorrhoids with good results even in the medium term (1-5 years) and a 12%-27% recurrence rate [12,13]. DGHAL for Grade II to IV hemorrhoids reportedly has good results, including a 90.7% overall success rate [14]. A systematic review, including 28 studies and 2904 patients, reported a pooled recurrence rate of 17.5% (of note, some Grade IV hemorrhoids were included), a postoperative bleeding rate of 5%, and a reintervention rate of 6.4% [15].

### 2.3. THD with mucopexy

THD has been increasingly performed as an alternative to CH. Ratto et al. reported that THD with mucopexy appears to be a safe and effective treatment for nonfibrotic Grade IV hemorrhoids, achieving significant symptomatic improvement in most patients [16]. At a median follow-up of 10 months, symptoms had resolved or significantly improved in 94% of patients. No serious complications, no anorectal stenosis, and no fecal incontinence were observed.

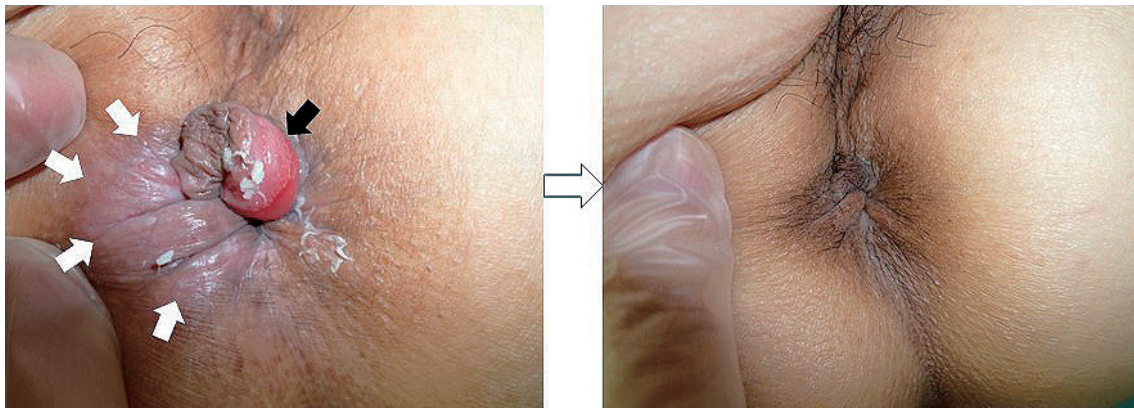
### 2.4. Sclerotherapy

#### ①ALTA sclerotherapy

Sclerotherapy is currently recommended for treatment of first- and second-degree hemorrhoids. ALTA, a promising new sclerosant, is clearly more useful than PAO for injection sclerotherapy, being more effective than PAO in achieving hemostasis [17]. The authors of a recent study found ALTA sclerotherapy to be an effective treatment for third-degree hemorrhoids. ALTA sclerotherapy on 603 patients, 169 of whom had Goligher Grade II and 435 Grade III hemorrhoids, had a high success rate for both Grade II (90%) and III (80%) hemorrhoids during a 5-year follow-up [18]. No serious or life-threatening complications occurred, and all patients improved with this conservative treatment [18]. ALTA differs from previously available sclerosants and may be effective against third-degree hemorrhoids [18,19].

ALTA, which is non-invasive, reduces inflow and induces persistent fibrosis, promoting adhesion and fixation of mucosal and submucosal layers to the muscular layer, leading to sclerosis and involution of the hemorrhoids [20,21].

ALTA sclerotherapy can be performed on an outpatient basis under local anesthesia. Furthermore, the clinical results of this form of treatment are very promising.



**Figure 1.** Photographs of Goligher Grade IV hemorrhoid pre- and post-ALTA sclerotherapy. The black arrow shows a prolapsed hemorrhoid (Grade IV). The white arrows show an area of perianal dermatitis due to mucus.

**Table 1.** Patient’s Characteristics According to the Goligher Grade of Hemorrhoids.

		Goligher grade		
		Grade II	Grade III	Grade IV
Number		47	119	14
Gender	male	20	64	7
	female	27	55	7
Age (y.o)		66±14	63±15	68±14
Intraoperative pulse wave Doppler	+	32	84	13
	-	15	35	1
Dose of ALTA (ml)		13±6	18±6	19±7
Operative time (minutes)		19±7	21±8	21±8
Postoperative complication	+	2	14	3
	-	45	105	11

ALTA sclerotherapy is performed for Grade II, III, and IV hemorrhoids [7]. Figure 1 shows the Grade IV prolapsed internal hemorrhoids with perianal dermatitis and pruritus. The symptoms of prolapse resolved immediately after injection of ALTA, with pruritus clearing within a month. There was reportedly no evidence of recurrence during 2 years of follow-up.

ALTA sclerotherapy for Grade IV hemorrhoids may be temporarily effective. I investigated the results of ALTA sclerotherapy in 180 patients attending my institution. The patient’s characteristics are shown in Table 1. Of the 180 patients, 47 had Goligher Grade II, 119 Grade III, and 14 Grade IV disease. The cumulative recurrence rates were 5.0% for Grade II, 9.2% for Grade III, and 28.6% for Grade IV hemorrhoids during 1 year of follow-up. The 3-year cumulative recurrence rates for Grade II, III, and IV hemorrhoids were 8.7%, 17.4%, and 36.5%, respectively. No serious or life-threatening complications occurred, and all patients improved with this conservative treatment. The cumulative recurrence rate was significantly higher for Grade IV than for Grade II or III disease, as shown in Figure 2, 3.

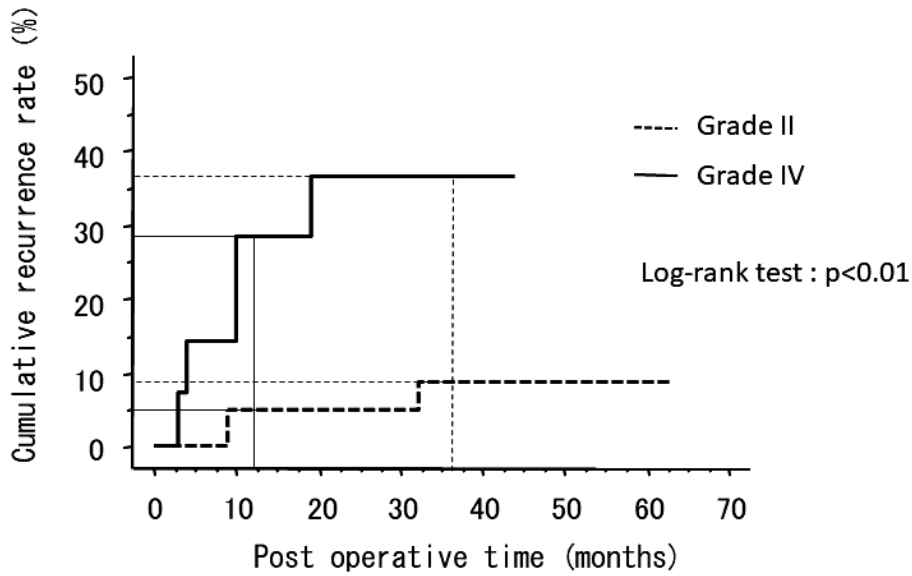
In the present study, ALTA sclerotherapy had few serious complications, in particular, there was no delayed hemorrhage requiring surgery. Yano et al. reported that the presence or absence of antithrombotic treatment does not affect the efficacy rate or rate of complications, including delayed hemorrhage, with ALTA sclerotherapy [22].

ALTA sclerotherapy is a proven minimally invasive procedure for internal hemorrhoids, most patients being satisfied with this treatment [23]. On the first postoperative day after ALTA sclerotherapy, the visual analog scale (VAS) score was 1.7 [24]. In contrast, VAS scores on the first postoperative day after SH and THD were reportedly 5.1 and 3.1, respectively [1].

②PAO sclerotherapy

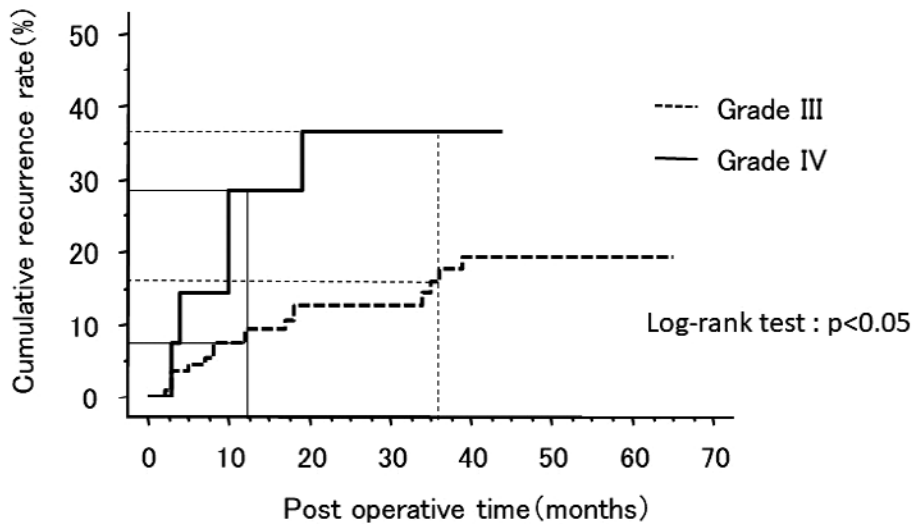
The use of 5% PAO can result in inflammation of hemorrhoidal tissue, leading to secondary fibrosis and decreased blood flow in hemorrhoidal tissue. This sclerosant was developed in Japan. PAO sclerotherapy is reportedly effective for internal hemorrhoids up to Grade III [7]. Another study found that PAO sclerotherapy is an effective treatment for Grade II hemorrhoids [8].

Cumulative recurrence rate	1-year	3-year
Grade II	5.0%	8.7%
Grade IV	28.6%	36.5%



**Figure 2.** Cumulative recurrence rates of Grade II and IV diseases after ALTA sclerotherapy. The recurrence rate is significantly higher for Grade IV than for Grade II hemorrhoids (Log-rank test:  $p < 0.01$ ).

Cumulative recurrence rate	1-year	3-year
Grade III	9.2%	17.4%
Grade IV	28.6%	36.5%



**Figure 3.** Cumulative recurrence rates of Grade III and IV diseases after ALTA sclerotherapy. The recurrence rate is significantly higher for Grade IV than for Grade III disease (Log-rank test:  $p < 0.05$ ).

### ③ *EIS and CAES*

EIS is one of the most prominent, cost-effective, and commonly used treatments for internal hemorrhoids [6]. Endoscopic retrograde sclerosis for internal hemorrhoids is technically well tolerated, with high patient satisfaction, a low complication rate, and satisfactory long-term results.

CAES, an endoscopic procedure for treating internal hemorrhoids, has emerged in recent years [25]. Zhang et al. reported that CAES is a safe, effective, and convenient endoscopic therapeutic procedure for Grade I, II, and III internal hemorrhoids [26].

### 2.5. *ACL*

ACL is a substitute for resecting Grade III and IV hemorrhoids [27]. Instead, of excising the hemorrhoids, in this procedure, the anal cushion is undermined around the anal ring, thus restoring the anatomical position of the prolapsed mucosa. Restoration of the anatomical position is achieved by suturing the cranial side and middle portion of the undermined anal cushion to the internal sphincter muscles. The recurrence rate was 2.4% (3/126) during a median follow-up of 26 months. There were no post-anal strictures or serious complications. The patients' anal cushions eventually shrank after this procedure. ACL preserves collateral venous vessels, facilitating anal cushion shrinkage and restoration of normal function.

Elimination of the congesting effect of a tight anal canal enables the anal cushions to revert to their normal state, resolving symptoms without removal of the cushions [28].

### 2.6. *RBL*

RBL is considered as the first-line treatment for Goligher Grade II hemorrhoids. The base of the hemorrhoid is visualized by anoscopy and controlled by either suction or forceps. A band is then applied to the base of the hemorrhoid, leading to necrosis and sloughing of the hemorrhoidal tissue [29]. Gagloo et al. reported that RBL is effective against bleeding and prolapse of Goligher Grade III hemorrhoids in 78% of cases. Although RBL is not as effective as CH for Goligher Grade III hemorrhoids, it does improve bleeding and prolapse [30]. This treatment is highly recommended for patients who are unfit for surgery or have comorbidities that contraindicate anesthesia.

### 2.7. *IRC*

IRC, which is a treatment for symptomatic Goligher II or III hemorrhoids, consists of applying infrared waves to the tissue, resulting in necrosis. Ricci et al. reported an equal success rate with less pain in the IRC group compared with the RBL group [31]. However, Jutabha et al. reported a success rate of 62% for IRC compared with 92% for RBL [32]. McLemore et al. reported that symptoms of internal hemorrhoids (bleeding, prolapse, pain, itching, burning, and soil-

ing) improve significantly after endoscopic IRC [5].

## 3. Education of Patients with Hemorrhoids after Minimally Invasive Treatment

Effective treatment of patients with hemorrhoids involves not only minimally invasive surgery but also education. He and Chen reported that, after sclerotherapy, patients should be educated about living habits [6]. Hemorrhoids are common and tend to recur. In He and Chen's study, doctors and nurses educated their patients after treatment, helping the treatment to succeed. They taught their patients to develop better living habits; more appropriately choose what to eat and drink; avoid constipation, diarrhea, and straining during defecation; take medications to soften the stools; and avoid prolonged sitting. Good education and management both improve the effectiveness of treatment and reduce the rate of recurrence of hemorrhoids.

## 4. Discussion

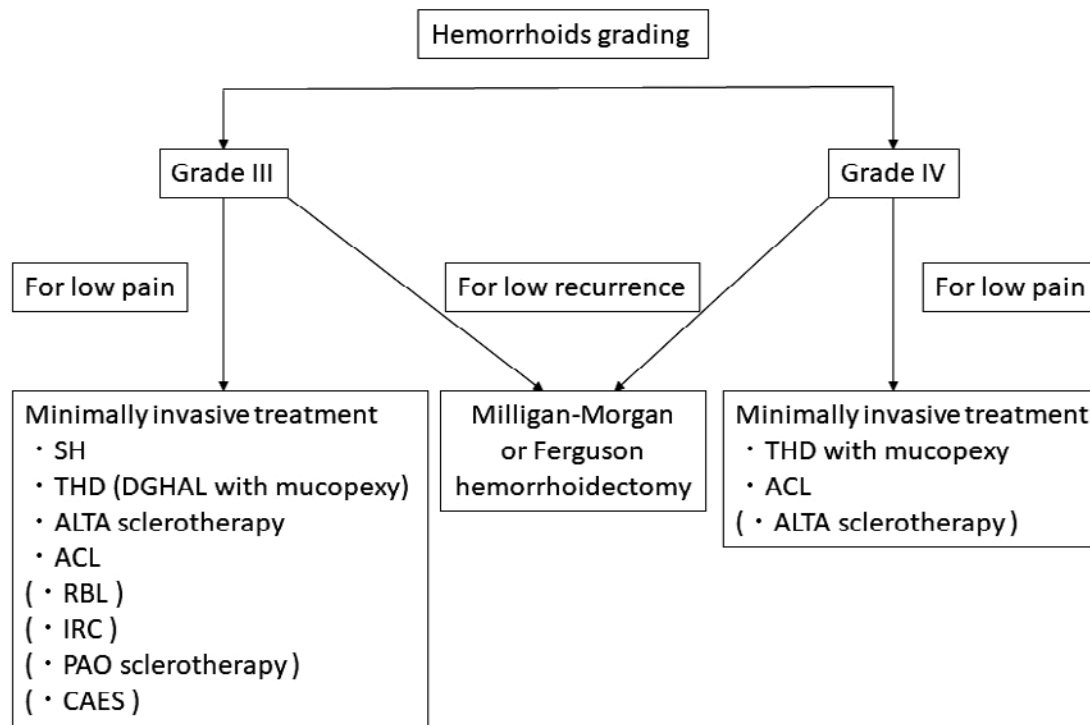
Some trials of minimally invasive treatment have been conducted for Grade III and IV hemorrhoids. Recurrence rates for each minimally invasive form of treatment are summarized in Table 2 [12-14,19,23,24,27,33-38]. The duration of postoperative follow-up differed widely between studies, ranging from 1 to 60 months. The rate of recurrence after minimally invasive treatment ranged from 0% to 21.8%.

Since 2000, the minimally invasive treatment of ALTA sclerotherapy has frequently been performed in Japan to treat internal hemorrhoids [18,19,38,39]. ALTA sclerotherapy has now been performed on over 300,000 patients in Japan for all Goligher grades of internal hemorrhoids. In the current case study, although ALTA sclerotherapy was effective in some cases of Grade IV disease, the recurrence rate was significantly worse for Grade IV than for Grade III hemorrhoids. ALTA sclerotherapy appears to be an effective treatment for Grade II and III hemorrhoids. ALTA sclerotherapy combined with distal hemorrhoidectomy is an option for treating mixed hemorrhoids, with the rate of prolapse repair being 100% [40]. More studies of ALTA sclerotherapy with distal hemorrhoidectomy are needed to establish its efficacy in Grade III and IV diseases.

Figure 4 shows an algorithm for the management of Goligher Grade III and IV hemorrhoids. CH is considered as the standard treatment for such hemorrhoids because of the low recurrence rate. If the top priority of patients with advanced hemorrhoids is a low risk of recurrence, CH, also known as Milligan-Morgan or Ferguson hemorrhoidectomy, should be selected. However, this procedure frequently results in severe postoperative pain. Additionally, excessive removal of sensitive anoderm or damage to the internal sphincter can occur during CH with excision of the anal

**Table 2.** Reported Recurrence Rates and/or Additional Surgery Rates for the Listed Minimally Invasive Treatments.

Author	Grade	Technique	Number	Follow-up (months)	Recurrence rate and/or additional surgery rate
Giordano P, et al [33]	IV	THD + mucopexy	31	32	6.4%
Ratto C, et al [34]	II, III, IV	THD	170	11.5	4.1%
Ratto C, et al [14]	II, III, IV	THD	803	11.1	10.2%
Zampieri N, et al [35]	III, IV	THD	46	1-6	0%
		Ligasure	68		4%
Theodoropoulos G.E, et al [36]	III, IV	DGHAL + RAR	147	15	4%
Walega P, et al [37]	III, IV	DGHAL + RAR	29	3	10.34%
Gravie J.F, et al [12]		SH	63	24	7.5%
		MMH	63		1.8%
Ammaturo C, et al [13]	III	SH	39	24	13%
		MMH	40		0%
Hachiro Y, et al [19]	III, IV	ALTA	448	29	3.6%
Takano M, et al [38]	III, IV	ALTA (OC-108)	80	12	16%
		CH	85		2%
Miyamoto H, et al [24]	II, III, IV	ALTA	28	5	10.7%
Miyamoto H, et al [23]	II	ALTA	109	60	10.8%
	III		435		21.8%
Ishiyama G, et al [27]	II, III, IV	ACL	127	26	2.4%



**Figure 4.** Algorithm for the management of Goligher Grade III and IV hemorrhoids.

cushions, resulting in some degree of fecal incontinence. If the patient’s top priority is minimizing pain, minimally invasive treatment options should be selected. The downside of minimally invasive and less painful treatments is the greater risk of recurrence; however, patients generally greatly appreciate sparing of the sensitive anoderm and a rapid return to

a normal, pain-free life [9].

The most important complications of CH are postoperative bleeding and anal stricture. Several technical modifications have been introduced in an attempt to prevent or to minimize postoperative complications. The most important of these is preserving the anoderm as much as possible. For

**Table 3.** Complications of Rubber Band Ligation and Sclerotherapy.

author	method	complication
Patel S, et al [41]	RBL	bleeding
Sim HL, et al [42]	RBL	perineal sepsis
Chau NG, et al [43]	RBL	pylephlebitis, pyogenic liver abscess
Tejirian T, et al [44]	RBL	bacterial endocarditis
Suppiah A, et al [45]	sclerotherapy (phenol)	chemical hepatitis
Rashid MM, et al [46]	sclerotherapy (PAO)	adult respiratory distress syndrome
Tanwar R, et al [47]	sclerotherapy (PAO)	recto-urethral fistula
Gupta N, et al [48]	sclerotherapy	recto-urethral fistula
Indrasena B, et al [49]	sclerotherapy (5%phenol)	necrotizing fasciitis
Elram R, et al [50]	sclerotherapy (5%phenol)	anorectal necrosis
Schulte T, et al [51]	sclerotherapy	rectal necrosis
Yang P, et al [52]	sclerotherapy	abdominal compartment syndrome
Bullock N [53]	sclerotherapy (5%phenol in arachis)	impotence
Yoshikawa K, et al [54]	sclerotherapy (ALTA)	acute liver injury

Goligher Grade III, rather than excising the hemorrhoids, the aims are to reduce their size by ligation of the supplying arteries and to restore the anatomical position of any prolapsed mucosa. THD, DGHAL, and SH all aim to correct the pathophysiology of hemorrhoids by reducing blood flow to the anal canal (dearterialization) and eliminating anorectal mucosal prolapse (repositioning), respectively. ACL also involves minimal harm to the anoderm and repositioning and fixing of the hemorrhoidal tissue. These procedures aim to correct the underlying pathophysiological mechanisms that result in hemorrhoids.

Nonsurgical treatments, such as RBL and sclerotherapy, are usually performed in outpatient clinics, thus reducing the costs of hospital stays. Moreover, these procedures are time-saving and minimize days off work [8], mainly because of the low rate and mildness of complications. Complications related to minimally invasive treatments for hemorrhoidal disease are reportedly usually mild, comprising mainly bleeding and pain [8]. In particular, one study found that complications of IRC are mild and include bleeding, ulceration, and dermatitis [31]; serious complications of minimally invasive treatments are rare. The major complications of RBL and sclerotherapy are summarized in Table 3 [41-54]. The most important severe adverse event is deep infection with pain, swelling, and redness after CAES because of incorrect positioning of the injected sclerosant [25]. Physicians should evaluate the patients' quality of life and discuss the treatment options with them to select the optimal approach for symptom relief and hemorrhoidal cure [6].

## 5. Conclusion

Although not definitive, minimally invasive treatments are a valid alternative for patients with symptomatic, advanced hemorrhoids provided that recurrence rates and possible

complications are clearly explained. Currently, various treatment options are available for patients with advanced hemorrhoids. Minimally invasive treatment may be ideal for symptomatic hemorrhoids that would otherwise require surgery.

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### Conflicts of Interest

There are no conflicts of interest.

### Author Contributions

Hidenori Miyamoto was the sole author and performed all required tasks.

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