ISSN: 3066-9812
Research Article
Journal of Clinical Epidemiology and Public Health

Hemorrhoidal Disease: A Comprehensive Review of Pathophysiology, Classification, and Evidence-Based Management

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Submitted: 16 December 2025 **Accepted:** 26 December 2025 **Published:** 31 December 2025

https://doi.org/10.63620/MKJCEPH.2025.1045

Citation: *Noskova, I., Apostolopoulos, A., Spiliotis, N. J., & Spiliotis, J. (2025). Hemorrhoidal disease: A comprehensive review of pathophysiology, classification, and evidence-based management. Manuscript submitted for publication. J of Clini Epi & Public Health, 3(6), 01-05.*

Abstract

Hemorrhoidal disease (HD) is a highly prevalent anorectal condition, affecting over 10 million individuals in the United States and with a global prevalence of 4.4% to 39%, leading to significant morbidity through symptoms such as bleeding, prolapse, pain, pruritus, and irritation that impair quality of life. Recent real-world evidence and meta-analyses highlight the role of conservative and minimally invasive treatments in reshaping management strategies, reducing recurrence, and enhancing patient outcomes.

Keywords: Catastrophic Healthcare Expenditure, Out-of-Pocket Payments, Universal Health Coverage, National Health Insurance Scheme, Household Health Expenditure, Socio-Economic Factors, Coping Strategies.

Introduction

HD is one of the most common anorectal disorders, responsible for over 2.2 million outpatient visits annually in the United States and affecting approximately 10 million people, with peak incidence between ages 45 and 65 [1-5]. Globally, prevalence varies from 4.4% to 39%, with 11% in adults reported in some studies, predominantly low-severity cases [2, 6]. Symptoms such as painless rectal bleeding, prolapse, pain, pruritus, and irritation often lead to embarrassment, delayed presentation, and reduced quality of life (QoL), occasionally causing anemia or severe discomfort [1, 7]. The economic burden is substantial, encompassing healthcare costs, procedures, and productivity losses [8].

Patients and Methods

This review synthesizes recent evidence from published meta-analyses, systematic reviews, and clinical studies on hemorrhoidal disease, focusing on the period from 2019 to 2025. A comprehensive literature search was conducted using electronic databases including PubMed, Embase, and Web of Science. Search terms included “hemorrhoids,” “hemorrhoidal,” “treatment,” and “management,” with filters for publication dates from 2019 to July 2024. Studies were included if they reported on conservative, office-based, or surgical interventions for hemorrhoidal disease, with an emphasis on randomized controlled trials (RCTs), cohort studies, and meta-analyses [3, 9].

Data extraction focused on patient demographics, hemorrhoid classification (Goligher, BPRST, or other), treatment modality, outcome measures (symptom resolution, pain scores, recurrence, complications, and patient satisfaction), and follow-up duration. Evidence was graded for certainty using the American Society of Colon and Rectal Surgeons (ASCRS) Toolkit methodology, considering risk of bias, inconsistency, indirectness, imprecision, and publication bias. Recommendations were influenced by the magnitude of effect and dose-response relationships.

Anatomy and Pathophysiology

The anal canal, about 4 cm long, is delineated by the dentate line, transitioning from viscerally innervated columnar epithelium above to somatically innervated squamous anoderm below. Anal

cushions, located submucosally in right anterior, right posterior, and left lateral positions, consist of arteriovenous sinusoids, Treitz's muscle, and elastic tissue, contributing 15-20% to resting anal pressure for continence and sphincter protection [10-12].

HD develops when cushions become symptomatic due to multifactorial mechanisms. The sliding anal canal theory describes degeneration of supportive tissue, causing distal prolapse, venous engorgement, and bleeding [1, 13]. Vascular hyperperfusion, confirmed by Doppler studies, increases arterial inflow [14]. Risk factors include straining (primary exacerbator), chronic constipation/diarrhea, low-fiber diets, prolonged toilet sitting, age-related degeneration, pregnancy (hormonal/mechanical), obesity, heavy lifting, genetic predisposition, pelvic floor dysfunction, and sedentary behavior [15]. Male gender and smoking may also contribute. Concomitance with chronic venous insufficiency is noted in 25% of cases, suggesting shared pathophysiology [16].

Classification Systems

The Goligher classification grades internal HD by prolapse: Grade I (no prolapse), II (spontaneous reduction), III (manual reduction), IV (irreducible) [17]. However, a 2025 review of 162 RCTs found 73.6% misuse, poor reliability (especially Grades II-III), and omission of symptoms/external components [18, 19]. Newer systems address this: BPRST integrates symptoms Gerjy/Nyström combines prolapse and external features Single Pile assesses bundles individually Nivatvongs includes bleeding [20, 21]. External HD is classified by thrombosis, mixed by combination. Patient-Reported Outcome Measures (PROMs) like HEMO-FISS-QoL and Hemorrhoidal Disease Symptom Score (HDSS) emphasize symptom impact [22, 23]. A 2024 survey of 1005 surgeons showed conservative preference for Grades I-II, surgery for III-IV.

Clinical Presentation and Diagnosis

Internal HD presents with painless bleeding, prolapse, mucus/pruritus; external with pain/thrombosis (bluish lump); mixed combine both. Acute thrombosis peaks pain in 48-72 hours. Diagnosis involves history (bleeding nature, red flags), inspection, digital rectal examination, anoscopy (gold standard) [24]. Colonoscopy for >50 years, anemia, or flags to rule out cancer, inflammatory bowel disease, fissures, abscesses, prolapse, condylomata, varices.

Results

Recent meta-analyses and systematic reviews have provided robust evidence on the outcomes of various treatments for hemorrhoidal disease. Surgical interventions consistently outperform conservative, noninvasive therapies in terms of symptom resolution, short-term pain relief, recovery time, and recurrence rates [25–27]. For example, a meta-analysis of seven studies found that surgical treatment led to significantly higher rates of achieving asymptomatic status and better pain relief compared to conservative approaches, with shorter recovery times and lower recurrence rates.

Laser hemorrhoidoplasty (LHP) combined with excisional hemorrhoidectomy (EH) has demonstrated favorable outcomes for grade IV hemorrhoids. In a retrospective comparison, LHP plus EH resulted in lower operation times (22.9 ± 9.2 min vs. 28.1 ± 11.8 min, $p = 0.0003$), less postoperative pain (VAS scores on operative day and postoperative day 1: 1.5 ± 1.4 vs. 2.1 ± 1.9, $p = 0.01$; 1.0 ± 1.0 vs. 2.0 ± 2.5, $p = 0.0002$), and reduced analgesic use compared to LigaSure hemorrhoidectomy (10). Additionally, the LHP plus EH group had a lower rate of urinary retention (0.8% vs. 1.7%, $p = 0.03$) and no cases of anal incontinence or stenosis during follow-up. Patient-reported outcomes, measured by the HDSS, showed significant improvement in pain and bleeding at postoperative week 6 (12.2 ± 3.9 vs. 8.7 ± 1.2, $p = 0.0003$).

For office-based procedures, the Rafaelo procedure (radiofrequency ablation) reported a complication rate of 17.6% (95% CI 8.8-26.3%), reoperation rate of 1.8% (95% CI 0.3-3.4%), and recurrence rate of 4.8% (95% CI 1.2-8.4%), with high patient satisfaction (95% CI 89.8-100%). When comparing LHP and rubber band ligation (RBL) in grade II patients, LHP showed significantly better outcomes for postoperative pain, bleeding, and earlier return to normal activities, though recurrence rates at one year were similar.

These findings highlight that surgical and minimally invasive procedures provide superior short-term outcomes, with lower recurrence and improved patient satisfaction, compared to conservative management.

Management Strategies

Conservative Management (All Grades)

ASCRS recommends conservative as first-line. Fiber (25-35g/day), hydration, habit modification reduce straining. Supplements like psyllium improve symptoms. Sitz baths, ice packs aid relief [28]. Venoactive drugs (VADs) (flavonoids) improve tone, reduce bleeding (OR 0.12) but recur 80% in 3-6 months. The CHORALIS study (3505 patients) showed VADs (micronized purified flavonoid fraction [MPFF] 73.7%) improved symptoms/QoL; MPFF superior (48.8% symptom-free vs. diosmin 34.4%, $p<0.001$; pain gone 69.7% vs. 52.8%, $p<0.001$; improvement 3.9 days). Topicals (lidocaine, hydrocortisone) offer temporary relief [29, 30].

Office-Based Procedures (Grades I-III Internal)

RBL: 89% resolution, superior for II-III (30). Sclerotherapy (polidocanol): 68-95%, 90% at 3 years [31, 32]. Infrared coagulation (IRC): 70-80% (33). Recent evidence indicates that IRC and Doppler-guided hemorrhoidal artery ligation (DG-HAL) show similar long-term recurrence rates, but IRC is favored for its safety and simplicity in outpatient settings [33].

Surgical Management (Grades III-IV, Mixed, Refractory)

Excisional (gold standard): 2-10% recurrence, 9-14 days recovery. Meta-analysis: less pain with laser (OR 0.34), IRC (0.38), stapling (0.48); less recurrence with Starion (0.01), harmonic (0.00); fewer complications with IRC (0.04), LigaSure (0.16); earlier return with Doppler (0.26), stapled (0.36) . Stapled: less pain, higher recurrence. Hemorrhoidal artery ligation with recto-anal repair (HAL-RAR): higher recurrence [34]. Thrombosed external: excision <72 hours (3.9 vs. 24 days resolution).

Emerging Techniques

Emborrhoid (superselective superior rectal artery embolization, SRAE) is minimally invasive, painless, preserves the anal

sphincter, and offers rapid recovery [35, 36]. Recent studies show short-term efficacy rates of 90% and long-term rates of 70–92%, with follow-up periods of 6–46 months [37]. SRAE is particularly suitable for patients with contraindications to conventional surgery or those who prefer a non-surgical approach. Flexible endoscopy is also emerging as a tool for precise, less invasive intervention with improved visualization and reduced iatrogenic risks.

Special Considerations

PROMs guide outcomes. Multidisciplinary for embolization. Pregnancy: conservative. Immunocompromised/cirrhosis: avoid invasive (9,38). Global: conservative for I-II (92.5%), surgery III-IV (77.6%).

Discussion

Hemorrhoidal disease management continues to evolve, with a growing emphasis on patient-centered care, minimally invasive techniques, and evidence-based guidelines. The traditional stepwise approach—starting with conservative measures, progressing to office-based procedures, and reserving surgery for advanced cases—remains the cornerstone of clinical practice, as reinforced by recent updates from the ASCRS. However, emerging innovations are reshaping the therapeutic landscape and addressing long-standing challenges such as recurrence, postoperative pain, and cost-effectiveness.

Conservative management, including dietary fiber, hydration, and VADs, is recommended as first-line therapy for all grades of hemorrhoidal diseas. While these approaches are effective for mild to moderate symptoms, recurrence rates remain high after cessation of VADs, highlighting the need for long-term pharmacological strategies and better patient education. Recent guidelines acknowledge the role of phlebotonics in clinical practice, albeit with a weak recommendation due to limited long-term data, suggesting ongoing uncertainty about optimal pharmacologic regimens.

Office-based procedures such as RBL, sclerotherapy, and IRC are well-established for grades I–III internal hemorrhoids. RBL is considered superior to sclerotherapy for symptom control and recurrence, though both are cost-effective compared to surgical interventions. The emergence of DG-HAL and endoscopic techniques has expanded options for patients seeking less invasive approaches, particularly those with comorbidities or high surgical risk. These modalities have shown favorable safety profiles and rapid recovery, though recurrence rates may be higher than with excisional hemorrhoidectomy.

Surgical management, including excisional hemorrhoidectomy, stapled hemorrhoidopexy, and newer techniques like hemorrhoidal artery embolization, is reserved for refractory or advanced disease. Excisional hemorrhoidectomy remains the gold standard for severe cases, but it is associated with greater pain and longer recovery. Minimally invasive procedures such as embolization offer promising alternatives, with high technical success and minimal adverse effects, making them suitable for patients who prefer non-surgical management or have contraindications to conventional surgery.

The integration of PROMs and multidimensional classification systems (e.g., BPRST, Gerjy/Nyström) is improving the precision of diagnosis and tailoring of therapy. PROMs enhance the ability to monitor symptom burden and guide treatment decisions, moving beyond purely anatomical criteria. Standardization of energy delivery in new modalities and cost-effectiveness analyses remain areas for further research.

In summary, the management of hemorrhoidal disease is increasingly shifting toward less invasive, patient-centered strategies supported by updated guidelines and technological advancements. However, gaps persist in long-term pharmacologic prevention, standardization of minimally invasive techniques, and cost-effectiveness, warranting ongoing research and multidisciplinary collaboration.

Future Research

Future research in hemorrhoidal disease should prioritize several key areas to further optimize patient outcomes and refine management strategies. Comparative effectiveness studies are needed to evaluate the long-term benefits and risks of emerging minimally invasive techniques, such as hemorrhoidal artery embolization, laser hemorrhoidoplasty, and radiofrequency ablation, against conventional surgical approaches. These studies should focus on recurrence rates, patient satisfaction, cost-effectiveness, and quality of life improvements across diverse populations.

Additionally, robust, long-term randomized controlled trials are essential to assess the efficacy of pharmacological prophylaxis, particularly VADs, in preventing recurrence after initial treatment, especially in high-risk groups such as pregnant women and those with chronic venous insufficiency. Genetic and lifestyle factors influencing disease progression and treatment response also warrant investigation, potentially enabling more personalized and preventive approaches.

Standardization of energy delivery in minimally invasive modalities and development of uniform protocols for PROMs are critical for reliable assessment of treatment outcomes and facilitating comparisons across studies. Furthermore, research should explore the integration of multidisciplinary care models, including collaboration between proctologists, interventional radiologists, and primary care providers, to optimize patient selection and improve adherence to treatment regimens [38].

Finally, future studies should address the economic burden of hemorrhoidal disease, including healthcare costs and productivity losses, to inform health policy and resource allocation. By advancing these research priorities, clinicians can continue to enhance the management of hemorrhoidal disease and improve the quality of life for affected individuals worldwide.

Conclusion

The management of hemorrhoidal disease has undergone significant evolution, transitioning from a predominantly anatomical and procedural focus to a more nuanced, patient-centered paradigm that prioritizes conservative VADs for acute and mild presentations, office-based procedures for mild-to-moderate symptomatic internal hemorrhoids, and surgical or minimally invasive interventions for advanced, refractory, or complex cases. This stepwise approach, as endorsed by the latest ASCRS

guidelines, not only aligns with the multifactorial pathophysiology—encompassing the sliding anal canal theory, vascular hyperperfusion, and diverse risk factors such as straining, low-fiber diets, obesity, and sedentary lifestyles—but also minimizes recurrence rates, which typically range from 0% to 56.5% across treatments, often falling below 20% with optimized strategies like MPFF supplementation.

Recent evidence from large-scale real-world studies, such as the CHORALIS trial involving over 3,500 patients, underscores the efficacy of VADs in rapidly alleviating symptoms like bleeding and pain, with MPFF demonstrating superior outcomes in symptom resolution (48.8% symptom-free at follow-up) and quality of life improvements compared to alternatives like diosmin, thereby supporting its role in both acute flares and potential long-term prevention. Furthermore, advancements in minimally invasive techniques, including hemorrhoidal artery embolization with its >97% technical success rate and negligible adverse effects, laser hemorrhoidoplasty offering reduced postoperative pain and faster recovery, and RFA for targeted tissue ablation, represent valuable additions to the therapeutic arsenal, particularly for patients averse to traditional excisional surgery's prolonged recovery (9–14 days) and higher pain burden.

Despite these strides, notable gaps persist, including the high recurrence following VAD cessation (up to 80% within 3–6 months) and the need for more robust, long-term randomized controlled trials to evaluate pharmacological prophylaxis against recurrence, especially in high-risk populations like pregnant women or those with comorbidities such as chronic venous insufficiency. The integration of updated classification systems beyond the limitations of Goligher—such as BPRST or Gerjy/Nyström, which holistically incorporate bleeding, prolapse, skin tags, and thrombosis—alongside validated PROMs like the HDSS, will further refine treatment tailoring and enhance clinical decision-making.

Multidisciplinary collaboration among proctologists, interventional radiologists, and primary care providers is imperative to optimize patient selection for emerging therapies and to address special considerations, including conservative approaches in pregnancy or immunocompromised states, ultimately fostering better adherence and outcomes. Looking ahead, future research should prioritize comparative effectiveness studies on these novel interventions, explore genetic and lifestyle modifiers of disease progression, and develop standardized protocols for PROM integration in routine practice. By embracing these evidence-based, individualized strategies, clinicians can substantially mitigate the substantial morbidity and economic burden of hemorrhoidal disease, empowering millions worldwide to regain comfort, productivity, and overall well-being in their daily lives.

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