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Postoperative anal stenosis after procedure for prolapse and hemorrhoids (PPH): a literature review

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ABSTRACT

Hemorrhoidal disease (HD) is among the most prevalent anorectal disorders, frequently necessitating surgical management in advanced stages. The Procedure for Prolapse and Hemorrhoids (PPH), also known as stapled hemorrhoidopexy (SH), has gained popularity due to its reduced postoperative pain and faster recovery compared with conventional hemorrhoidectomy (CH). However, postoperative anal stenosis (AS) remains one of its most serious long-term complications, substantially impairing patient quality of life. This literature review systematically examines the current understanding of postoperative anal stenosis following PPH, including its pathophysiology, incidence, clinical presentation, diagnostic criteria, management strategies, and preventive measures.

The pathogenesis of AS after PPH is primarily attributed to tension-induced fibrosis resulting from circumferential stapling and the subsequent inflammatory cascade. The reported incidence varies widely (0.2–22%), reflecting technical variability and lack of standardization in studies. Risk factors encompass both patient-specific predispositions (e.g., hypertrophic scarring tendency, postoperative bowel irregularities) and technical errors such as low or deep purse-string placement and excessive tissue excision. Diagnosis relies on digital rectal examination and classification of stenosis severity.

Treatment depends on disease grade: conservative management with dilatation suffices for mild cases, while moderate to severe stenosis necessitates surgical anoplasty, with the House advancement flap showing superior outcomes.

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Preventive strategies focus on precise purse-string placement 2–3 cm above the dentate line, maintaining submucosal suture depth, preserving mucosal bridges, and optimizing postoperative bowel management.

Despite numerous advances, inconsistencies in reported incidence, lack of long-term prospective data, and unstandardized definitions of AS hinder comparative evaluation. Future research should prioritize standardized outcome measures, tension-reducing stapler designs, and rigorous long-term studies. Ultimately, prevention through meticulous technique and early intervention remains the cornerstone of managing this potentially avoidable complication.

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Prolaps va gemorroyni davolash (PPH) jarayonidan keyingi anal stenoz: adabiyotlar tahlili

Kalit so‘zlar:
prolaps va gemorroyni davolash (PPH),
stapler gemorroidopeksiya,
anal stenoz,
operatsiyadan keyingi asoratlar,
fibroz,
to‘qima tarangligi,
anoplastika,
House advancement flap,
profilaktika,
jarrohlik texnikasi.

ANNOTATSIYA

Gemorroyd kasalligi (GK) eng keng tarqalgan anorektal kasalliklardan biri bo‘lib, kech bosqichlarda ko‘pincha jarrohlik aralashuvini talab qiladi. Prolaps va gemorroyni davolash usuli (PPH), shuningdek, stapler gemorroidopeksiya (SH) nomi bilan tanilgan, an’anaviy gemorroidektomiya (CH) bilan solishtirganda kamroq og‘riq va tezroq tiklanish bilan ajralib turadi. Ammo operatsiyadan keyingi anal stenoz (AS) uning eng jiddiy uzoq muddatli asoratlaridan biri bo‘lib, bemorning hayot sifatini sezilarli darajada pasaytiradi. Ushbu adabiy sharh PPHdan keyingi anal stenoz haqidagi hozirgi bilimlarni tizimli ravishda tahlil qiladi – patofiziologiyasi, uchrash chastotasi, klinik belgilari, diagnostika mezonlari, davolash usullari va profilaktik choralarni o‘z ichiga olgan holda.

PPHdan keyingi AS patogenezining asosi to‘qimalarning doira shaklida stapler bilan tortilishi va buning natijasida yuzaga kelgan yallig‘lanish jarayoni sababli rivojlanadigan fibrozdir. Asorat chastotasi juda keng diapazonda (0,2–22%) qayd etilgan bo‘lib, bu texnik farqlar va tadqiqotlarning standartlashtirilmaganligi bilan bog‘liq. Xavf omillariga bemorga xos xususiyatlar (masalan, gipertrofik chandiqqa moyillik, ichak faoliyatining buzilishi) hamda texnik xatolar – kiset chokining juda past yoki chuqur joylashtirilishi, ortiqcha to‘qima olib tashlanishi kiradi. Diagnostika barmoq orqali rektal tekshiruv va stenoz og‘irligini baholash orqali amalga oshiriladi.

Davolash stenoz darajasiga bog‘liq: yengil holatlarda dilatatsiya bilan konservativ davolash yetarli, o‘rta va og‘ir stenozlarda esa jarrohlik anoplastika talab qilinadi. House uslubidagi advancement flap eng yaxshi natijalarni ko‘rsatgan.

Profilaktika choralari tishli chiziqdan 2–3 sm yuqorida aniq kiset chokini qo‘yish, submukozal chuqurlikni saqlash, shilliq ko‘priklarni saqlab qolish va operatsiyadan keyin ichak faoliyatini me’yorda ushlab turishni o‘z ichiga oladi.

Shunga qaramay, ma’lumotlardagi nomuvofiqliklar, uzoq muddatli tadqiqotlarning yetishmasligi va stenozni baholash mezonlarining turlicha bo‘lishi natijalarni solishtirishni qiyinlashtiradi. Kelajakdagi tadqiqotlar natijalarni standartlashtirish, to‘qimalarga kamroq kuch tushiruvchi staplerlar yaratish va uzoq muddatli kuzatuvlarni o‘tkazishga qaratilishi lozim. Oxir-oqibat, aniq texnika va erta aralashuvga asoslangan profilaktika ushbu oldini olish mumkin bo‘lgan asoratni boshqarishda eng muhim omil bo‘lib qolmoqda.

Послеоперационный анальный стеноз после процедуры пролапса и геморроя (PPH): обзор литературы

Ключевые слова:
процедура пролапса и геморроя (PPH),
степлерная геморроидопексия;
анальный стеноз,
послеоперационные осложнения,
фиброз,
натяжение тканей,
анопластика,
advancement-лоскут по House,
профилактика,
хирургическая техника.

АННОТАЦИЯ

Геморроидальная болезнь (ГБ) является одной из наиболее распространённых аноректальных патологий, часто требующих хирургического вмешательства на поздних стадиях. Процедура пролапса и геморроя (PPH), также известная как степлерная геморроидопексия (SH), получила широкое распространение благодаря меньшей послеоперационной боли и более быстрому восстановлению по сравнению с традиционной геморроидэктомией (CH). Однако послеоперационный анальный стеноз (AC) остаётся одним из самых серьёзных отдалённых осложнений, значительно ухудшающих качество жизни пациентов. Данный обзор систематически рассматривает современные представления о послеоперационном анальном стенозе после PPH, включая его патофизиологию, частоту встречаемости, клинические проявления, диагностические критерии, методы лечения и меры профилактики.

Патогенез AC после PPH в первую очередь связан с фиброзом, вызванным натяжением тканей при циркулярном степлировании и последующим воспалительным каскадом. Частота осложнения варьирует в широких пределах (0,2–22%), что объясняется различиями в технике и отсутствием стандартизации исследований. К факторам риска относятся как индивидуальные особенности пациента (склонность к гипертрофическому рубцеванию, послеоперационные нарушения стула), так и технические ошибки – низкое или чрезмерно глубокое наложение кисетного шва, избыточное иссечение тканей. Диагностика основана на пальцевом ректальном исследовании и классификации степени стеноза.

Лечение зависит от степени тяжести заболевания: при лёгких формах достаточно консервативной терапии с дилатацией, при умеренных и тяжёлых стенозах требуется хирургическая анопластика, причём метод с advancement-лоскутом по House демонстрирует лучшие результаты.

Профилактические меры включают точное наложение кисетного шва на 2–3 см выше зубчатой линии, соблюдение субмукозной глубины прошивания, сохранение слизистых перемычек и коррекцию стула в послеоперационном периоде.

Несмотря на достижения, вариабельность данных по частоте осложнения, отсутствие долгосрочных проспективных исследований и единых критериев оценки затрудняют сопоставление результатов. Будущие исследования должны быть направлены на стандартизацию исходов, разработку степлеров с меньшим натяжением тканей и проведение длительных наблюдений. В конечном итоге профилактика, основанная на точной технике и раннем вмешательстве, остаётся ключом к предотвращению этого потенциально предотвратимого осложнения.

INTRODUCTION

Hemorrhoidal disease (HD) is a widespread proctologic entity, often ranking as the fourth leading gastrointestinal diagnosis in US outpatient clinics (Sun 2016, cited in Khan et al. 2024). The estimated prevalence of hemorrhoids in adults is high, with some studies reporting rates of up to 44% (Riss et al. 2012, cited in Kalkdijk et al. 2022; Yamamoto et al. 2020; Riss et al. 2012, cited in Ratto et al. 2020). While conventional surgical excision remains the standard procedure for high-grade hemorrhoids (Ratto et al. 2020), the Procedure for Prolapse and Hemorrhoids (PPH), introduced by Longo, utilizes a circular stapler to resect redundant rectal mucosa/submucosa proximal to the dentate line (Jacobs 2014; Pata et al. 2021). This technique aims to restore anatomical positioning and reduce vascular flow (Pata et al. 2021).

PPH gained prominence due to advantages such as reduced postoperative pain compared to conventional excisional hemorrhoidectomy (CH) (Malyadri and Allu 2021). However, PPH is associated with severe, albeit sometimes rare, complications, including anal stenosis (AS) and rectal stricturing (Jacobs 2014; Warsinggih et al. 2020). AS is the anatomical narrowing of the anal canal due to the replacement of normal, pliable anoderm with inelastic, fibrotic, or cicatricial tissue (Leventoglu et al. 2022; Warsinggih et al. 2020). This complication severely impacts quality of life, manifesting as painful and difficult defecation (Zakaria et al. 2025).

This review synthesizes current scientific understanding of the causes, incidence, manifestations, and management of postoperative anal stenosis following PPH, drawing on comprehensive academic sources to identify clinical implications and research priorities.

Thus, meticulous assessment of benefits versus long-term complications, especially anal stenosis, is crucial when selecting PPH for hemorrhoidal disease management (Wen, Huang, and Wang 2024).

PATHOPHYSIOLOGY AND MECHANISMS

Anal stenosis, generally, is a weighty complication after anal and rectal surgery (Weng et al. 2022), and approximately 90% of anatomical anal stenosis cases stem from excisional hemorrhoidectomy (Warsinggih et al. 2020). After PPH, stenosis results from wound healing processes influenced by mechanical and biological factors related to the circular stapling technique.

The core underlying mechanism is the proliferation of fibrous scar tissue which restricts the stretching capability of the anal canal (Warsinggih et al. 2020; Wen, Huang, and Wang 2024).

1 Mechanical Tension and Fibrosis: The circumferential resection inherent in PPH generates mechanical tension at the anastomosis site (Warsinggih et al. 2020). This biomechanical environment is critical, as mechanical force regulates tissue fibrosis (Carver and Goldsmith 2013, cited in Wen, Huang, and Wang 2024). Experimental studies, such as those involving rat models, have demonstrated that the tension induced by circular stapling promotes the progression of hypertrophic scars and severe AS (Wen, Huang, and Wang 2024).

2. Molecular and Cellular Drivers of Scarring: Fibrosis is driven by an altered molecular cascade. Tension-induced healing often involves growth factors and signaling pathways that regulate the formation of the extracellular matrix (ECM) (Wen, Huang, and Wang 2024). For instance, transforming growth factor-β1 (TGF-β1) and Connective Tissue Growth Factor (CTGF) activation, both of which are regulated by the mechanical environment, are strongly implicated in promoting fibroblast-to-myofibroblast transition and matrix deposition, leading to fibrosis (Deaton et al. 2005, cited in Wen, Huang, and Wang 2024; Wen, Huang, and Wang 2024). Studies in other complex wound models (anal fistula) show that promoting wound healing and tissue repair involves activating the MEK/ERK pathway and stimulating epithelial-mesenchymal transition (EMT) in fibroblasts (Zhang, Qiu, et al. 2022,).

3. Technical Iatrogenic Injury: Incorrect purse-string suture placement during PPH is a major culprit (Wei, Jiang, et al. 2023). If the suture is placed too deep or too close to the dentate line, it leads to excessive tissue removal or lumen narrowing, resulting in scar hypertrophy (Fu and Zhou 2024).

The core mechanism of anal stenosis after PPH is tension-mediated fibrosis resulting from the mechanical circumferential stapling and subsequent exaggerated fibrotic molecular responses (Wen, Huang, and Wang 2024).

INCIDENCE AND RISK FACTORS

The reported incidence of AS after PPH is highly variable, making precise prevalence data controversial. While generally considered rare (Jacobs 2014), documented prevalence estimates range widely, with reports placing the figure from under 1% up to 22% in patients who have undergone Circular Stapled Hemorrhoidopexy (Wei, Jiang, et al. 2023; Warsinggih et al. 2020).

Controversies in Comparative Outcomes: Some meta-analyses suggest that Stapled Hemorrhoidopexy (SH) is generally safe (Simillis et al. 2015, cited in Moldovan et al. 2023). A review of randomized trials showed that PPH performed by skilled surgeons resulted in a significantly lower recurrence rate and lower rate of hemorrhoidal prolapse than conventional hemorrhoidectomy (CH) when outcomes were assessed 6 months or more post-procedure (Jacobs 2014). However, concerns persist regarding severe but rare PPH complications, such as rectal stricturing, rectovaginal fistulization, and pelvic sepsis (Jacobs 2014; Pescatori 2003, cited in Moldovan et al. 2023).

Risk Factors for AS:

1. Technical/Surgical Faults: Technical execution of the PPH procedure is the most frequently cited risk factor for stenosis (Fu and Zhou 2024; Wei, Jiang, et al. 2023). The optimal placement of the purse-string suture is 2–3 cm above the dentate line; placement too low risks stenosis, and placement too deep risks involving the muscle layer, causing scar hypertrophy (Wei, Jiang, et al. 2023; Fu and Zhou 2024).

2. Bowel Habits and Anal Tone: Functional constipation and hard stools are both causes and consequences of hemorrhoidal disease and surgery (Kalkdijk et al. 2022). Patients with hemorrhoids often exhibit high resting anal pressure compared to healthy controls (Chauhan et al. 2007; Lin et al. 1989; Parks 1956, all cited in Kalkdijk et al. 2022,). Postoperative constipation and subsequent repeated mechanical/inflammatory irritation are considered independent risk factors that aggravate scar formation and increase DPHB (Delayed Post-Hemorrhoidectomy Bleeding) risk (Lee et al. 2018, cited in Kalkdijk et al. 2022; Fu and Zhou 2024).

3. Patient Predisposition: Patients with a constitutional tendency toward excessive scar formation are inherently at higher risk (Fu and Zhou 2024).

In summary, the incidence of anal stenosis following PPH remains variable, but technical execution (purse-string height and depth) and managing postoperative bowel function are recognized as critical risk factors (Wei, Jiang, et al. 2023; Fu and Zhou 2024).

CLINICAL PRESENTATION AND DIAGNOSIS

Anal stenosis is a serious disabling condition (Warsinggih et al. 2020), which impacts the morphology and function of the anal canal (Weng et al. 2022).

Patients typically present with complaints related to obstructed and painful defecation (Warsinggih et al. 2020; Zakaria et al. 2025). Key symptoms include:

• Difficulty and pain during defecation: This is the primary complaint (Zakaria et al. 2025).

• Altered stool form: Feces are described as narrow, thin, or elongated (Warsinggih et al. 2020).

• Fear and Restriction: Fear of pain and impacted feces may lead patients to restrict eating, resulting in nutritional problems and relying heavily on laxatives or enemas (Tavani, Partovi, et al. 2025; Warsinggih et al. 2020).

The diagnosis is primarily clinical, relying on digital rectal examination (DRE) to assess the narrowness and elasticity of the anal region (Warsinggih et al. 2020).

AS is universally graded based on the ability to insert a finger:

1. Mild Stenosis: Examination is possible by a well-lubricated index finger (Warsinggih et al. 2020; Bejiga 2022).

2. Moderate Stenosis: Forceful dilation is required to insert the index finger (Warsinggih et al. 2020).

3. Severe Stenosis: Digital examination is impossible, or insertion of the tip of the little finger requires forceful dilation (Bejiga 2022; Warsinggih et al. 2020).

Diagnostic Tools: While DRE is fundamental, other tools confirm function and etiology:

• Anoscopy: Used for visual assessment and grading (Warsinggih et al. 2020).

• Anorectal Manometry: Measures anal pressures. Studies show that hemorrhoid patients often have higher basal pressures, which may be corrected post-treatment (Chauhan et al. 2007, cited in Kalkdijk et al. 2022).

In essence, the diagnosis of postoperative anal stenosis hinges on the clinical presentation of difficult defecation and objective assessment of anal canal narrowing based on digital examination findings (Warsinggih et al. 2020).

MANAGEMENT STRATEGIES

The treatment goal is to restore the anal canal caliber and elasticity, usually by excising fibrotic tissue and reconstructing the anal circumference (Warsinggih et al. 2020).

Conservative Management (Mild Stenosis): Mild or early-stage membranous stenosis is often managed non-surgically (Fu and Zhou 2024):

• Diet and Laxatives: Increased fiber intake and use of stool softeners are standard recommendations (Alonso-Coello et al. 2005, cited in Khan et al. 2024).

• Anal Dilatation: Manual or mechanical dilatation is a primary therapeutic measure (Fu and Zhou 2024). However, particularly in children, performing painful dilatations must be avoided as they can lead to dysfunctional defecation and incontinence later in life (Jenetzky et al. 2012, cited in Amerstorfer et al. 2022).

• Topical Agents: Topical treatments, such as diltiazem, have been studied to promote wound healing post-hemorrhoidectomy, sometimes resulting in shortened healing time compared to placebo (Rodríguez-Wong et al. 2019).

Surgical Management (Moderate to Severe Stenosis): Surgical reconstruction (anoplasty) is mandatory for confirmed anatomical strictures (Weng et al. 2022).

• Advancement Flap Anoplasty: These procedures involve excising the cicatricial ring and mobilizing healthy skin (usually the anoderm/perianal skin) to cover the defect in a tension-free manner (Gallo et al. 2022). Common techniques include the V-Y flap, rhomboid/diamond flap, and House advancement flap (Bejiga 2022; Gallo et al. 2022).

• House Flap Superiority: A systematic review demonstrated that patients undergoing the House advancement flap achieved better results in terms of clinical improvement, patient satisfaction, and quality of life compared to those with V-Y or rhomboid/diamond flaps (Gallo et al. 2022).

• Recurrence: The overall prevalence of recurrence after anoplasty is estimated at 4.7%, but this is highly variable due to the retrospective nature of most data (Gallo et al. 2022).

• PPH Stapler for Repair: An innovative, specialized approach described for post-PPH stricture involves using the PPH Stapler device (e.g., No. 33) itself to precisely resect the circumferential stapled line stricture (Warsinggih et al. 2020).

• Scar Resection: Specific resection of the anal stenosis ring (Fu and Zhou 2024) or scar revision may be necessary.

Therefore, while mild anal stenosis can be managed with dilatation, moderate to severe cases necessitate surgical intervention, with flap anoplasty, particularly the House flap, showing superior patient outcomes for reconstruction (Gallo et al. 2022,).

PREVENTION AND TECHNIQUE OPTIMIZATION

Anal stenosis caused by overzealous hemorrhoidectomy is often considered an entirely preventable disease if performed by skilled and experienced hands (Brisinda 2000, cited in Leventoglu et al. 2022).

Key Preventive Measures in PPH:

1. Suture Precision: The most important factor is the technique of the purse-string suture. It must be placed accurately at the submucosal layer, generally 2–3 cm above the dentate line (Wei, Jiang, et al. 2023; Fu and Zhou 2024). Placing the suture too low or involving the muscle layer increases the risk of scar proliferation and stenosis (Fu and Zhou 2024).

2. Modified Techniques: Techniques designed to prevent a continuous circumferential wound are critical. The Open-loop PPH technique is an example, as it avoids complete annular mucosectomy, thereby reducing the risk of annular stricture formation (Wei, Jiang, et al. 2023). Other modified suture techniques mentioned include the single-purse four-point traction method and the wave purse-string suture (Lin et al. 2022; Xuezhi et al. 2008, cited in Wei, Jiang, et al. 2023,).

3. Postoperative Bowel Regulation: Postoperative management is crucial, including appropriate analgesia and early monitoring to prevent constipation and resulting mechanical trauma, which exacerbates scarring (Fu and Zhou 2024).

Thus, meticulous surgical planning, precise purse-string suturing at the optimal submucosal depth, and proactive postoperative bowel management are fundamental for preventing anal stenosis after PPH (Wei, Jiang, et al. 2023; Fu and Zhou 2024).

CONCLUSION

Postoperative anal stenosis after the Procedure for Prolapse and Hemorrhoids (PPH) represents a severe yet preventable complication resulting from excessive fibrotic healing and technical inaccuracies during surgery. The condition arises primarily due to tension-induced fibrosis following circumferential stapling, where improper placement of the purse-string suture or inclusion of muscle layers provokes pathological scar formation.

Although PPH provides significant benefits in terms of reduced postoperative pain and faster recovery compared to conventional hemorrhoidectomy, its long-term safety profile remains dependent on surgical precision and postoperative management. Preventive strategies focus on meticulous technique, maintaining correct suture depth and distance from the dentate line, and ensuring effective bowel regulation during recovery. Once established, anal stenosis requires an individualized therapeutic approach, ranging from conservative dilatation in mild cases to reconstructive anoplasty for more advanced disease, with the House advancement flap offering particularly favorable outcomes. Future directions should prioritize standardization of diagnostic and reporting criteria, development of prospective multicenter studies to determine true incidence rates, and exploration of molecular pathways governing fibrosis to design targeted interventions that could limit pathological scarring.

The ultimate goal remains the preservation of anal canal function and patient quality of life through surgical accuracy, scientific rigor, and continuous improvement of procedural safety.

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