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Chronic Rhinosinusitis with Nasal Polyps: Clinical Features, Impact on Quality of Life and Treatment Approaches - a review

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Abstract

Introduction: Chronic rhinosinusitis with nasal polyps (CRSwNP) is a chronic inflammatory disease of the nasal cavity and paranasal sinuses characterized by bilateral nasal polyps, persistent symptoms, and a marked reduction in quality of life. The condition is commonly associated with type 2 inflammation and frequently coexists with asthma and aspirin-exacerbated respiratory disease.

Aim: The aim of this review is to present current evidence-based approaches to the diagnosis and conservative and surgical management of chronic rhinosinusitis with nasal polyps.

Materials and Methods: This narrative review is based on international guidelines, systematic reviews, and key clinical studies addressing the pathophysiology, diagnosis, and treatment of CRSwNP.

Results: Diagnosis of CRSwNP requires chronic sinonasal symptoms lasting at least 12 weeks with objective confirmation of nasal polyps on endoscopy or imaging. First-line treatment includes long-term intranasal corticosteroids and saline irrigation, with short courses of systemic corticosteroids used in severe cases. Biologic therapies targeting type 2 inflammatory pathways are effective in selected patients with severe or refractory disease. Endoscopic sinus surgery remains an essential treatment option when medical therapy fails, providing significant symptom relief and improved quality of life.

Conclusions: Optimal management of CRSwNP requires an individualized, stepwise approach integrating medical treatment, surgical intervention, and biologic therapy to achieve long-term disease control.

Keywords: chronic rhinosinusitis, nasal polyps, CRSwNP, endoscopic sinus surgery, biologic treatment

Introduction

Chronic rhinosinusitis with nasal polyps (CRSwNP) is a chronic inflammatory disorder of the nasal cavity and paranasal sinuses, characterized by the presence of benign, bilateral polypoid lesions arising from the sinonasal mucosa. It represents a distinct clinical phenotype of chronic rhinosinusitis and constitutes a significant health problem due to its high prevalence, chronic course, and considerable impact on patients' quality of life (1,2).

Epidemiological studies indicate that chronic rhinosinusitis affects approximately 5–12% of the adult population (1); among these patients, chronic rhinosinusitis with nasal polyps

accounts for approximately 25–30% of cases and shows a male predominance (3).
CRSwNP is associated with persistent nasal obstruction, anterior or posterior nasal discharge, facial pressure, and olfactory dysfunction, symptoms that often lead to sleep disturbances, impaired daily functioning, fatigue and reduced work productivity (1). Consequently, the disease imposes a significant socioeconomic burden and requires long-term medical attention.

The aim of this review is to present current approaches to the conservative and surgical management of nasal polyps, based on established clinical evidence and international guidelines. By summarizing key aspects of disease pathophysiology, diagnosis, and treatment strategies, this article seeks to provide a comprehensive overview of evidence-based management options for patients with CRSwNP.

Etiopathogenesis of Chronic Rhinosinusitis with Nasal Polyps

Chronic rhinosinusitis with nasal polyps is a heterogeneous inflammatory disorder of the sinonasal mucosa, characterized by persistent polypoid lesions and epithelial barrier dysfunction. The pathogenesis of nasal polyps is complex, involving a combination of immune dysregulation, epithelial barrier defects, and environmental factors, including the local microbiome (4).

A dominant mechanism in most CRSwNP cases is type 2 inflammation, driven primarily by eosinophils, mast cells, and type 2 innate lymphoid cells (ILC2s). Cytokines such as IL-4, IL-5, and IL-13 orchestrate the recruitment and activation of these cells, promoting tissue edema, polyp formation, and mucosal remodeling (5,6). Elevated levels of thymic stromal lymphopoietin (TSLP), IL-25, and IL-33 produced by epithelial cells further amplify the type 2 inflammatory response, creating a self-sustaining proinflammatory microenvironment (7).

Epithelial barrier dysfunction is another key factor in polyp formation. Impaired tight junction integrity and increased epithelial permeability facilitate allergen penetration and microbial colonization, leading to chronic immune activation (7). Dysregulation of IL-6 and other proinflammatory mediators contributes to epithelial damage and persistent inflammation, which are hallmarks of nasal polyp pathogenesis (6).

Environmental exposures, such as air pollution, allergens, dust, and smoke, can damage the sinonasal epithelial barrier and exacerbate chronic inflammation, potentially contributing to polyp formation and disease persistence (8).

The nasal microbiome also plays an important role in the inflammatory environment. Alterations in the sinonasal microbiome may influence the inflammatory environment, modulating both the intensity and the type of immune response (9). Colonization of the mucosa by Staphylococcus aureus and the release of its enterotoxins further exacerbate type 2 inflammation, promoting eosinophilia and polyp formation (10).

Overall, the pathogenesis of nasal polyps reflects a multifactorial interplay between immune dysregulation, epithelial barrier defects, and environmental exposures. Understanding these mechanisms is critical for developing targeted therapies, including biologic agents that selectively modulate type 2 inflammation and reduce the burden of recurrent disease (11).

Clinical Symptoms and Diagnosis

Clinical Symptoms

Chronic rhinosinusitis with nasal polyps presents with a spectrum of symptoms resulting from persistent sinonasal inflammation and polyp formation. The most characteristic clinical features include nasal obstruction or congestion, anterior and/or posterior rhinorrhea, decreased or absent sense of smell (hyposmia or anosmia) and facial pain/pressure (12). These symptoms are generally chronic, persisting for at least 12 weeks, and often fluctuate in severity over time (13). CRSwNP frequently coexists with comorbidities such as asthma and aspirin-exacerbated respiratory disease (AERD), which can exacerbate symptom severity and complicate disease management (14). Patients often report significant impact on daily life, sleep disturbances, and reduced quality of life, highlighting the need for timely recognition and appropriate management (15).

Assessment of Symptom Severity

The severity and impact of CRSwNP symptoms on quality of life are commonly assessed using the Sino-Nasal Outcome Test (SNOT-22), a validated patient-reported questionnaire (16). Each of these clinical parameters: need to blow nose, nasal blockage, sneezing, runny nose, cough, postnasal discharge, thick nasal discharge, ear fullness, dizziness, ear pain, facial pain or pressure, decreased sense of smell / taste, embarrassed, difficulty falling asleep, waking up at night, lack of good night’s sleep, wake up tired, fatigue, reduced productivity,

reduced concentration, frustrated, restless, irritable, sad is rated in scale from 0 to 5 where 0 is no problem and 5 is problem as bad as it can be. The test evaluates 5 domains: nasal, ear/facial, sleep, function, and emotion, providing a comprehensive measure of disease burden (17). A statistically supported severity classification was derived for the SNOT-22 instrument, defining mild disease as scores between 8 and 20, moderate disease as scores greater than 20 up to 50, and severe disease as scores exceeding 50 (18).

Diagnosis

The diagnosis of chronic rhinosinusitis with nasal polyps is based on a combination of patient-reported symptoms, physical examination, and objective confirmation of nasal polyps.

Nasal endoscopy is the mainstay of objective evaluation, allowing direct visualization of bilateral polyps and assessment of mucosal edema, discharge, and anatomical variations (19,20). Endoscopy not only confirms the presence of polyps but also helps determine severity, extent, and suitability for medical or surgical intervention.

Computed tomography (CT) of the paranasal sinuses is recommended when endoscopic findings are unclear, when surgery is being considered, or to assess sinus anatomy and polyp burden. CT provides precise information about sinus opacification, polyp size, and bony structures, which is essential for surgical planning (19).

According to international guidelines, diagnosis requires at least two cardinal symptoms persisting for ≥12 weeks, alongside objective confirmation of polyps via endoscopy or imaging (21). Proper diagnosis is crucial to guide management strategies, including medical therapy and surgical intervention, particularly in patients with severe, recurrent, or refractory disease.

Conservative Treatment

The management of chronic rhinosinusitis with nasal polyps typically begins with medical or conservative therapy, aimed at reducing inflammation, controlling symptoms, and improving quality of life.

Intranasal Corticosteroids (INCS)

Intranasal corticosteroids remain the cornerstone of medical therapy for CRSwNP (22). They work by reducing mucosal inflammation, inhibiting eosinophil recruitment, decreasing

cytokine release, and limiting polyp growth. Regular use has been shown to improve nasal obstruction, rhinorrhea, and sense of smell, and can delay or reduce the need for surgical intervention (23). There are several delivery methods for INCS, including sprays, drops, and exhalation delivery systems (EDS). EDS and high-volume irrigation methods may enhance penetration into the paranasal sinuses, particularly in patients with large or recurrent polyps, providing greater symptom control than conventional sprays alone (23). INCS are generally well tolerated, with minimal systemic absorption, though long - term use requires monitoring for potential local adverse effects such as epistaxis, nasal dryness, or mucosal irritation (24). The most common intranasal corticosteroids are listed in Table 2 (based on (25–28).

Generation of intranasal corticosteroids	Intranasal corticosteroid	Comments
First generation	Beclomethasone dipropionate Triamcinolone acetonide Flunisolide Budesonide	Mometasone furoate is the most frequently prescribed intranasal corticosteroid in clinical practice. The most common modalities of INCS administration are nasal sprays and nasal douches. The standard daily dose of modern INCSs ranges from 200 to 800 μg. Higher doses (1200–2800 μg) have been used in randomized trials; however, their effectiveness is similar to that of lower INCS doses, which are associated with fewer adverse effects.
Second generation	Ciclesonide Fluticasone furoate Fluticasone propionate Mometasone furoate Betamethasone sodium phosphate	

Table 2. Intranasal corticosteroids pharmacology.

Nasal Saline Irrigation

Saline irrigation is frequently used as an adjunct to INCS. It helps to remove mucus, allergens, and inflammatory mediators, promoting sinus drainage and enhancing the effectiveness of topical medications (29). Large-volume saline irrigation is generally recommended for optimal benefit (30).

Oral Corticosteroids (Systemic Steroids)

Short-course oral corticosteroids are widely used in patients with chronic rhinosinusitis with nasal polyps, especially for severe symptoms, exacerbations, or perioperative management (31). They can produce rapid but transient improvements in nasal obstruction, polyp size, sense of smell, and disease-specific quality of life (32). Evidence suggests that oral steroids are most effective as short-term therapy (up to 21 days) and are not recommended for long - term use due to potential systemic side effects, including hypothalamic–pituitary–adrenal axis suppression, metabolic changes, and gastrointestinal disturbances (33).

Leukotriene receptor antagonists

Leukotriene receptor antagonists (LTRAs), such as montelukast, can be used as adjunctive therapy. Evidence suggests they may improve nasal obstruction, symptoms, and quality of life, particularly in patients with eosinophilic polyps or comorbid asthma, but are generally not used as monotherapy (34,35). LTRAs are well tolerated, and may provide additional benefit when combined with intranasal corticosteroids, though further large-scale studies are needed to clarify their exact role (36).

Biologic Therapy

Biologic therapies have become an important option for patients with severe chronic rhinosinusitis with nasal polyps who do not respond adequately to intranasal corticosteroids (37). These therapies target key mediators of type-2 inflammation, including IL-4, IL-5, IL-13, and IgE, thereby reducing nasal polyp size, nasal obstruction, and symptom burden, and improving disease-specific quality of life (38). The most commonly used biologics in CRSwNP include dupilumab (anti-IL-4/IL-13), omalizumab (anti-IgE), and mepolizumab (anti-IL-5) (39) Clinical studies show that these agents can reduce the need for systemic corticosteroids and revision surgery, particularly in patients with high eosinophil counts or comorbid asthma (40). Network meta-analyses suggest that dupilumab often provides the most rapid and pronounced improvements, although the optimal choice depends on individual patient characteristics (41). Overall, biologics represent a personalized treatment strategy for

severe CRSwNP, offering effective symptom control and improved quality of life in carefully selected patients (42).

Overall, conservative therapy is the cornerstone of CRSwNP management, aiming to control inflammation, prevent polyp recurrence, and reduce the need for surgical intervention. Regular follow-up is essential to assess symptom control, monitor treatment response, and adjust therapy as necessary (3).

Surgical Treatment Options in Chronic Rhinosinusitis with Nasal Polyps

Surgical management constitutes an essential component of treatment for patients with chronic rhinosinusitis with nasal polyps who fail to achieve adequate disease control with optimal medical therapy (43). The primary objectives of surgery include removal of polypoid tissue, restoration of sinus ventilation and drainage, reduction of inflammatory burden, and facilitation of postoperative topical drug delivery (44). Endoscopic techniques remain the standard of care and have demonstrated significant benefits in symptom relief and quality of life improvement (45).

Functional Endoscopic Sinus Surgery (FESS)

Functional endoscopic sinus surgery (FESS) is the most widely accepted and effective surgical approach for CRSwNP (46). The procedure involves endoscopic removal of nasal polyps and enlargement of sinus ostia to restore normal airflow and mucociliary clearance. Recent evidence confirms that FESS leads to significant improvements in nasal obstruction, olfactory function, facial pressure, and disease-specific quality of life, as measured by validated tools such as SNOT-22 (47). A twelve-year follow-up study reported durable improvement in quality of life and symptom control after FESS, although recurrence remained common, particularly in patients with severe inflammatory phenotypes (48). Similarly, a large clinical outcome study identified asthma, aspirin-exacerbated respiratory disease (AERD), tissue eosinophilia, and extensive preoperative disease as key predictive factors for postoperative recurrence (49). FESS is generally considered safe, with low rates of major complications. A recent large-scale analysis confirmed high effectiveness of endoscopic surgery with a low incidence of adverse reactions, reinforcing its role as a first-line surgical intervention in refractory CRSwNP (50).

Extended Endoscopic Sinus Surgery (EESS)

Extended endoscopic sinus surgery (EESS) refers to more aggressive surgical approaches involving wide opening of all paranasal sinuses, including the frontal, ethmoid, sphenoid, and maxillary sinuses (51). This technique is primarily reserved for patients with severe, diffuse, or recurrent CRSwNP, particularly those with pronounced type 2 inflammation, asthma, or AERD (52,53). Long - term outcome studies demonstrate that EESS can achieve improved disease control and prolonged symptom relief in carefully selected patients (54). Long - term outcome studies have reported reduced symptom burden and improved postoperative topical medication penetration, albeit with a slightly increased surgical complexity and risk profile compared with standard FESS (55).

Polypectomy

Polypectomy involves targeted removal of visible nasal polyps using forceps or microdebriders and may be performed as a standalone procedure or as part of FESS (56). While polypectomy can provide rapid symptomatic relief, particularly of nasal obstruction (57), it does not address underlying sinus pathology and is associated with higher recurrence rates compared with comprehensive FESS (58).

Balloon Sinuplasty

Balloon sinuplasty is a minimally invasive technique that dilates sinus ostia using inflatable balloon catheters without extensive tissue removal (59). Its role in CRSwNP is limited, as it does not remove polypoid tissue or significantly reduce inflammatory load. Current evidence suggests that balloon sinuplasty may be considered only in selected patients with mild disease or as an adjunct to FESS, rather than as a standalone treatment (60).

Summary

In summary, surgical treatment of CRSwNP encompasses a spectrum of endoscopic techniques ranging from limited polypectomy to extended endoscopic sinus surgery. FESS remains the gold standard for patients refractory to medical therapy, offering significant

symptom relief and quality of life improvement. However, given the chronic and recurrent nature of CRSwNP, surgery should be integrated into a comprehensive, long - term management strategy that includes postoperative medical therapy and careful follow-up to optimize outcomes and minimize recurrence.

Conclusions

Chronic rhinosinusitis with nasal polyps (CRSwNP) is a complex, heterogeneous inflammatory disease that poses a substantial clinical and socioeconomic burden due to its chronic course, high prevalence, and significant impact on patients' quality of life. The disease is driven by multifactorial mechanisms involving epithelial barrier dysfunction, immune dysregulation - predominantly type 2 inflammation - and environmental and microbial factors, underscoring the need for a comprehensive and individualized approach to management.

Conservative treatment remains the foundation of CRSwNP management. Intranasal corticosteroids are the cornerstone of therapy and should be used as long - term maintenance treatment to control inflammation, reduce polyp burden, and prevent recurrence. Adjunctive therapies, including large-volume saline irrigation, short courses of systemic corticosteroids for severe exacerbations, and leukotriene receptor antagonists in selected patients, provide additional symptom control but must be tailored to individual risk–benefit profiles. Symptom severity and disease burden should be regularly assessed using validated patient-reported outcome measures such as SNOT-22 to guide treatment decisions and monitor response.

For patients with severe or refractory disease, particularly those with comorbid asthma or aspirin-exacerbated respiratory disease, biologic therapies targeting key mediators of type 2 inflammation have emerged as an effective and personalized treatment option. These agents significantly reduce symptom burden, polyp size, and the need for systemic corticosteroids or repeated surgery, representing a major advancement in CRSwNP care.

Surgical intervention, most commonly endoscopic sinus surgery, remains an essential component of treatment for patients who do not achieve adequate control with maximal medical therapy. Surgery improves sinonasal ventilation, facilitates topical drug delivery, and enhances quality of life; however, postoperative medical therapy and long - term follow - up

are crucial to minimize recurrence, especially in patients with eosinophilic inflammation or comorbid respiratory disease.

In conclusion, optimal management of CRSwNP requires a multidisciplinary, stepwise, and patient-centered approach that integrates medical therapy, surgical intervention when indicated, and emerging biologic treatments. Continued research into disease endotypes, biomarkers, and long - term outcomes will further refine personalized treatment strategies and improve the prognosis for patients with this chronic and often recurrent condition.

Disclosure

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