

# Surgical Management of Polyps in the Treatment of Nasal Airway Obstruction

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## KEYWORDS

- FESS • Nasal polyps • Sinonasal polyps • Polyp treatment
- Nasal obstruction

In addition to their role in chronic rhinosinusitis and nasal congestion, sinonasal polyps are associated with significant nasal obstruction. Via a purely mechanical effect (ie, obstruction at its simplest level), polyps alter and otherwise block the normal flow of air through the nose. Similarly, by blocking the drainage pathways of the paranasal sinuses, sinus inflammation and its associated symptom of congestion occur. Because the pathway that leads to the formation of sinonasal polyps has not been completely elucidated, effective long-term treatments remain difficult to pinpoint.

Management of these polyps, therefore, is a difficult challenge for the contemporary otolaryngologist. Some of the more common medical treatment options include: topical and oral steroids; macrolide antibiotics; diuretic nasal washes; and intrapolyp steroid injection. Surgical options include polypectomy and functional endoscopic sinus surgery (FESS). In addition, novel treatments for polyps are introduced with some frequency. This article presents an overview of management options for sinonasal polyps, focusing on the indications, efficacy, and complications of the more common interventions.

## DIAGNOSIS AND PREVALENCE OF SINONASAL POLYPS

Diagnosis of sinonasal polyps relies primarily on nasal endoscopy, with computed tomography (CT) to evaluate the extent of disease. Although unilateral polyposis often requires adjunctive studies such as magnetic resonance (MR) imaging for further evaluation, endoscopy and CT are usually sufficient to evaluate bilateral, symmetric polyposis.

In the attempt to create valid, reproducible rhinoscopic methods to characterize bilateral sinonasal polyps, multiple staging systems have been proposed.<sup>1,2</sup>

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Examination of five of these scoring systems found reproducibility in three of the systems. Interestingly, the same study also found that polyp size (and score) correlated more directly to symptoms of nasal congestion than to nasal blockage.<sup>3</sup> This distinction between nasal blockage and nasal congestion is often overlooked but is important.

Work continues on the creation of a reproducible, easy to perform endoscopic scoring system. CT scans are helpful in attempts to quantify the extent of polyp disease and they are essential before any surgical intervention. CT characterization of sinonasal polyps has been well-elucidated by a variety of studies and includes infundibulum enlargement, bony attenuation of the ethmoid trabecula, and the presence of nonenhancing soft tissue formations of a mucoid matrix density, among other traits.<sup>4,5</sup> As polyps are expansile and, in some cases, may expand and erode the skull base,<sup>6</sup> CT is essential for gathering data on the state of the skull base in these patients.

The prevalence of sinonasal polyps is a matter of continued debate. Although most authors cite a prevalence of 1% to 4%,<sup>7</sup> some studies report rates as high as 32%.<sup>8</sup> One study noted a 4.2% prevalence of polyps in a group of patients followed for asthma and rhinitis,<sup>9</sup> while a separate, population based questionnaire sent out by researchers in Finland demonstrated a prevalence of 4.3%.<sup>10</sup> In neither of these studies, however, did respondents undergo nasal endoscopy, which is the gold standard for diagnosis of nasal polyposis. When nasal endoscopy was performed by Johansson and colleagues on a random sample of 1387 Swedish citizens, polyps were identified in 2.7% of the subjects. In their study from 2004, Larsen and Tos<sup>8</sup> identified polyps in 32% of nasal endoscopies performed during 69 consecutive autopsies. Of patients who had polyps, however, 72% of the polyps were smaller than 5 mm in greatest diameter and were not likely to be clinically relevant. The conclusion that small polyps may lead to few symptoms is supported by a 2002 study by Larsen and Tos, which demonstrated that only a small subset of those patients with nasal polyps develop sinonasal complaints.<sup>11</sup>

The prevalence of both symptomatic and asymptomatic nasal polyposis is increased in certain subsets of the population. Patients who have cystic fibrosis, asthma, age greater than 60 years, Churg-Strauss syndrome, or sarcoidosis, or who are male, have been shown to suffer from increased rates of nasal polyposis.<sup>12-15</sup>

## PHYSIOLOGY OF SINONASAL POLYPS

Debate continues about the exact pathophysiology of sinonasal polyps, despite much research in this area. Several studies support the idea of the development of polyps as a byproduct of sinonasal inflammation. Although the source of inflammation may be variable (eg, mechanical trauma, bacteria, viruses, fungi, and environmental allergens have all been suggested), researchers theorize that these inciting events lead to disruption of the epithelial lining and initiate a resultant inflammatory cascade. If this inflammation does not subside in its normal timely fashion, stromal edema consolidates and may result in polyp formation.<sup>16</sup>

It has been suggested that an ineffective local Th1-based immune response in these patients is associated with increased Th2-based activity, which contributes to a chronic infection as well as to an increased presence of eosinophils, which then lead to further polyp formation.<sup>17</sup> It has been further proposed that the weakened Th1-response in these patients may be secondary to the down-regulation of some specific toll-like receptors involved in the innate immune response.<sup>18,19</sup> Sinonasal polyps are highly associated with the presence of tissue eosinophilia.

As mentioned, the source of this eosinophilia continues to be investigated. Some authors have focused on a decreased rate of local eosinophilic apoptosis and have postulated the elevated expression of surviving, an inhibitor of protein apoptosis, as the source of this reduced eosinophilic apoptosis.<sup>20,21</sup> Others have documented the increased expression of the chemokines eotaxin and Regulated on Activation Normal T Expressed and Secreted (RANTES) as having a major role in the increased eosinophilic inflammation.<sup>22,23</sup> Others have focused on increased levels of such pro-inflammatory cytokines as tumor necrosis factor, interferon, granulocyte-macrophage colony-stimulating factor (GM-CSF), and interleukin (IL)-5 as a source of the increased inflammatory cells in polyps.<sup>24,25</sup>

The failure of lymphangiogenesis in sinonasal mucosa has also been suggested as a contributing factor to the persistence of stromal edema and eventual polyp formation.<sup>26</sup> Anatomic factors may also play a role in initiation of this inflammatory cascade, as polyps have been noted to appear predominately in structurally tight areas of the sinonasal pathway. Abnormalities in nitrous oxide metabolism, superantigen production, and elevated levels of metalloproteinases are just a few of the other abnormalities found in association with sinonasal polyps.<sup>27-29</sup> Although much has been learned in the past few years concerning the development of sinonasal polyps, much more remains to be elucidated.

### MEDICAL TREATMENT OF POLYPS

Patients who have nasal polyposis often experience severe nasal airway obstruction, and have been shown to carry a significantly greater health burden than patients who have chronic rhinosinusitis but no polyp disease.<sup>30</sup> Treatment options vary and they include topical and oral steroids, intrapolyp steroid injection, office polypectomy, and surgery (most commonly FESS). Lesser known and less widely accepted treatments include the use of macrolides,<sup>31</sup> intranasal capsaicin,<sup>32-34</sup> intranasal furosemide,<sup>35</sup> Amphotericin B nasal spray,<sup>36</sup> intranasal lysine-acetylsalicylic acid,<sup>37</sup> UV phototherapy, and anti-leukotriene medications.

Despite this lengthy list of treatment options for nasal polyps, the mainstay of contemporary medical management continues to be intranasal and oral systemic corticosteroids.<sup>38</sup> Steroids likely act on polyps by decreasing the concentration of eosinophils and IgE via the up-regulation of anti-inflammatory genes.<sup>39,40</sup> Some authors have demonstrated increased apoptosis of inflammatory cells and fibroblasts in nasal polyps after steroid administration.<sup>41-43</sup> Through gene array techniques, other researchers have shown the impact of steroids on gene expression.<sup>44</sup> Several studies have demonstrated the clinical efficacy of topical steroids in patients with nasal polyps,<sup>45,46</sup> while other studies have demonstrated on a histologic level a decrease of inflammatory cells after use of topical steroids.<sup>47,48</sup> Fillici and colleagues<sup>49</sup> demonstrated in a randomized, double-blind placebo-controlled study the efficacy of intranasal steroid sprays. In their study, 157 patients with bilateral nasal polyposis were randomized to receive nasal steroid spray or placebo. Patients who received steroids showed statistically and clinically significant improvement in nasal symptoms and polyp size when compared with those who received placebo. Although topical steroids are usually applied via nasal spray, one paper has demonstrated efficacy of manual application directly into the frontal sinus; many other rhinologists have begun to advocate the off-label use of stronger steroids such as Pulmicort for use in nasal washes or applied directly as nasal drops.<sup>50</sup> Systemic steroids are more potent, and have been shown to be more effective at decreasing polyp eosinophilia when compared with steroid sprays.<sup>51</sup>

A recent Cochrane database review of the effectiveness of oral steroids on sino-nasal polyps demonstrated that, although there exists a need for well-designed prospective randomized controlled trials, existing studies do support efficacy of oral steroids as treatment for polyposis.<sup>52</sup> One such study did document the clinically significant improvement in symptoms in patients with sinonasal polyps after a 2-week course of prednisolone.<sup>53</sup> Any consideration of systemic steroids must, of course, include screening patients for relative contraindications (diabetes, emotional instability, hypertension, glaucoma, history of tuberculosis), as well as informing patients of potential systemic side effects.

### **STEROID INJECTION OF POLYPS**

Intranasal steroid injection has been used as a means to deliver a high concentration of steroids directly into inflammatory lesions, such as polyps, without the systemic side effects normally associated with steroids. There is, unfortunately, no level I evidence in support of steroid injections for sinonasal polyposis. Most studies are small, anecdotal, or retrospective. Of particular concern is the associated risk of ocular complication with intranasal steroid injection.

Specifically, there have been sporadic reports of temporary and permanent visual loss after intranasal steroid injection most likely caused by retinal artery embolization and vasospasm. Retrograde embolization may occur when the small steroid particle flows in reverse through the anterior or posterior ethmoid arteries to the ophthalmic artery and then into the central retinal artery where it causes a vaso-occlusive event. Although it is unusual for this to occur, it has been suggested that the risk of complication may be decreased further by following some specific guidelines. These guidelines include: recommendation for the choice of a steroid with a small particle size such as Triamcinolone acetonide; drawing up this steroid with a small gauge needle; and pre-procedure use of a topical vasoconstrictor to reduce nasal vascular congestion. The use of Triamcinolone acetonide has the added advantage of being a steroid suspension of small particles whose local effects continue for several weeks. Recommendations have also been made against intra-operative injection. It remains the case that more is unknown about the benefits and risks of steroid injection for sinonasal polyps than is known. Although steroid injection appears to be an effective nonsurgical modality for treating polyps, it is unclear how it compares to topical and oral steroids in regards to efficacy and systemic absorption. There is a small but real risk associated with steroid injection. The risks and benefits should be discussed with the patient. Informed consent should be obtained before administration of a steroid injection.

### **SURGICAL TREATMENT OF POLYPS**

It has been suggested that up to 50% of patients who have sinonasal polyps may eventually require surgical intervention.<sup>54</sup> Although office polypectomy is performed less frequently today than in the past, it continues to be a useful tool for use by the contemporary otolaryngologist. In traditional office polypectomy, polyps are removed with a surgical tonsil snare after appropriate topical anesthesia and vasoconstriction. The principles for office polypectomy remain essentially unchanged from their description by Hippocrates in 400 BC in which he secured polyps through the loop end of a tin curette tied to a string, and avulsed them through the mouth by pulling on the string.<sup>55</sup> In more recent times, authors have described polypectomy in the clinic setting using powered endonasal instrumentation as more precise and less traumatic than traditional office snare polypectomy.<sup>56,57</sup> Although it is largely impractical to perform polypectomy in the clinic setting on patients who have a large polyp burden,

it remains a viable option for patients who have a small volume of polyps, or patients who have had a few recalcitrant polyps grow back after surgery, despite aggressive medical therapy.

It has been demonstrated that, in patients who have a high burden of sinonasal polyps, sinus surgery can result in a marked reduction of polyps with a consequent improvement in nasal obstruction and quality of life.<sup>58</sup> Although patients who have sinonasal polyps often have associated anatomic abnormalities and thinning of their skull base, which places them at increased intraoperative risk, advances in endoscopic and computer navigation technology, powered instrumentation, and increasingly effective anesthesia have all combined to make surgery in these patients relatively safe. In the few polyp patients who do suffer anterior skull base trauma, the more common site is the anterior aspect of the ethmoid roof just posterior to the frontal recess, and not the lateral lamella of the cribriform plate as may be commonly expected.<sup>59</sup>

Several studies have documented the efficacy of endoscopic sinus surgery for sinonasal polyposis. One study by Batra and colleagues<sup>60</sup> recorded marked improvement in sinonasal symptomatology in patients with nasal polyps and asthma who underwent FESS. Another paper with a mean follow-up period of 5 years found improved functional outcomes in polyp patients who underwent sinus surgery with improvement in nasal obstruction, rhinorrhea, facial pain, and anosmia.<sup>61</sup> Multiple other studies have been published with similar findings supportive of the efficacy of endoscopic sinus surgery as an effective means for the treatment of symptoms secondary to sinonasal polyposis.<sup>62,63</sup>

Most sinus surgery for nasal polyposis involves standard, as well as powered endonasal instrumentation, for polyp removal and “nasalization” of the sinuses. Over the years, several “novel” tools have been applied to the removal of sinonasal polyps. One such tool, the KTP laser, was reported to be very effective in the surgical management of recurrent nasal polyps.<sup>64</sup> Other clinicians have also focused on the role of KTP laser in the management of recurrent polyps. Dr. Howard Levine reported an 81% success rate in a series of 52 patients treated with KTP laser in the face of recurrent polyposis.<sup>65</sup> Others have reported success with the Nd:YAG laser for the treatment of small polyps. Described advantages of laser use in the surgical management of sinus and nasal polyps include improved hemostasis capabilities and flexible operating modes. Although this technology seems appealing, there is currently no compelling data to support its use for polyp management.

Other tools have also been suggested as a means to surgically remove polyps with improved hemostasis. Coblation surgery in particular has been described as “associated with a statistically significant lower estimated blood loss and blood loss per minute when compared with traditional microdebridement technique.”<sup>66</sup> These results are preliminary and will require future studies for validation. Balloon technology has been introduced as a minimally invasive means for the treatment of sinonasal disease. It should be noted that because the balloon does not remove tissue or bone but rather enlarges existing ostia, it has not been deemed an effective tool for the treatment of sinonasal polyps.

### COMBINED TREATMENT OF POLYPS

Although multiple studies have shown the utility of sinus surgery for patients who have nasal polyposis, it should not be thought of as a panacea but rather as a method to start to manage patients with an excessive polyp burden because the surgically excised polyps will inevitably recur without aggressive medical management. Deal

and Kountakis<sup>30</sup> demonstrated an association between the presence of nasal polyposis and an increased need for revision surgery. Wynn and Har-El<sup>67</sup> also showed significantly higher rates of recurrent surgery in patients with nasal polyposis than those without polyps. Despite the increased rates of revision, it has been documented that patients with polyps may achieve similar improvement after sinus surgery as non-polyp patients.<sup>68</sup> To diminish the need for and frequency of revision surgery, patients with sinonasal polyps must be treated with an aggressive medical regimen before and after surgery. There is evidence that administration of systemic steroids in the postoperative period for patients who have polyps may have a significant impact on their postoperative course.<sup>69</sup> Surgery for patients who have polyps should be viewed as the first step in management of a chronic disease process that will require careful monitoring and treatment with topical and oral medications.

### SUMMARY

The contemporary otolaryngologist has a variety of means to treat nasal obstruction that results from polyposis. Although the goal is create a favorable local sinonasal environment in which medical therapy can successfully keep polyps from reforming, many patients – especially those with a large polyp burden – require surgery to help them achieve this favorable environment. Fortunately, advances in the understanding of sinus anatomy and changes with polyposis, along with many available technological advancements, combine to make surgery safer, more efficient, and more complete than in the past.

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