

# Perioperative care for functional endoscopic sinus surgery



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## Abstract

*Despite recent advancements in both medical and surgical treatment for chronic rhinosinusitis (CRS), this condition still causes very significant morbidity and reduction of quality of life in those patients who suffer from it. If medical therapy fails to improve symptoms sufficiently then surgery is offered. However some patients experience persisting or recurrent symptoms after surgical intervention so there is scope to improve the efficacy of current perioperative care. There is however surprisingly limited scientific evidence on which to base a rational regimen of perioperative care. This article will review the currently available evidence, and highlight where deficiencies in our knowledge lie.*

## Keyword

*CRS, sinusitis, chronic sinusitis, chronic rhinosinusitis, treatment, preoperative, postoperative.*

## Introduction

For the initial treatment of uncomplicated chronic rhinosinusitis (CRS) it is generally accepted practice to prescribe a course of medical therapy. Surgical intervention is offered only when medical options have been exhausted or when complications have arisen.<sup>1</sup> However there is no universal consensus on the appropriate optimal medical treatment and many different protocols are currently used, usually involving a combination of oral and topical corticosteroids, antibiotics and nasal saline lavages. There is even less evidence on efficacy of medical therapy administered specifically in the immediate perioperative period.

CRS is characterized by persistent inflammation of the mucosa of the nose and paranasal sinuses, and it can be diagnosed definitively once the presence of such inflammation has been confirmed using nasal endoscopy and/or computerized tomography (CT). The mucosal inflammatory response of CRS probably results from an immunologically mediated reaction to the presence of bacteria and fungi colonizing the nose and paranasal sinuses. Obstruction of the sinus ostia by such inflammation is thought to provide a local

environment that encourages the growth of microorganisms.<sup>2</sup>

Functional endoscopic sinus surgery (FESS) has undergone major developments over the last 25 years, and now the paranasal sinus ostia can be enlarged as far as the surrounding anatomy allows. However, operative disruption of the mucosal lining promotes scarring and crusting that can result in further inflammation and infection of the sinus mucosa. If sinus patency is not achieved and maintained in the early postoperative period, the long-term outcome may be compromised.

Postoperative care would ideally facilitate an environment in which remucosalization of the sinuses is facilitated, while crusting, infection and scarring are kept to a minimum so that patency of the surgically enlarged ostia is maintained. Scarring and adhesions form predominantly in the first two postoperative weeks. Topical treatments that can be kept in contact with the mucosa for a prolonged period of time may prove to be the most effective way to minimize scarring. The respiratory epithelium of the sinus mucosa is ciliated and has an overlying layer of mucus. These two components work in tandem to

remove inhaled pathogens and any other substances foreign and potentially harmful to the nasal mucosa. Restoring and maintaining mucociliary clearance is an important goal of perioperative medical care in FESS.

### Pre-Operative Medical Therapy

The number of studies of the impact of preoperative medication on postoperative course is limited. Available therapies include intranasal and oral corticosteroids, antibiotics and saline lavage.

#### Topical steroids

The current European guidelines advocate topical corticosteroids as a first-line treatment on the basis of several studies that have demonstrated evidence of improvement in nasal symptoms as well as reduction in polyp size.<sup>1</sup> Improvement in symptoms has also been demonstrated in patients with CRS without nasal polyposis. In a trial which measured variability of volume of medication retained within nasal tissues among several topical corticosteroid sprays, it was found that fluticasone furoate displayed highest tissue binding and therefore an extended presence within nasal tissue.<sup>3</sup>

However, no studies have currently shown the superiority of one topical steroid preparation in terms of efficacy in CRS. Although the systemic absorption of all topical steroids is small because of their high first pass metabolism, it would seem reasonable to prescribe the more modern agents with the lowest systemic bioavailability. Also, given that topical corticosteroids are advocated as first line treatments, patients undergoing FESS are usually on long term therapy which extends to the perioperative period.

#### Oral steroids

In a recent study involving 60 adults with CRS with polyps, a course of combined oral followed by topical corticosteroids was found to be more effective in symptom improvement and polyp reduction over 6 months than topical corticosteroid alone.<sup>4</sup> Another study demonstrated not only a reduction in polyp size with systemic steroids, but also found a significant reduction in the levels of ECP, IL-5 and IgE in the nasal secretions of the patients treated with corticosteroids.<sup>5</sup> This study found that polyps began to recur after completion of the two week course of corticosteroids, but the polyp score was still significantly less than in the placebo group. Neither of these two studies specifically addressed whether preoperative treatment with oral corticosteroids facilitated operative removal of polyps or improved postoperative outcome. There is evidence that suggests a reduction in intraoperative bleeding in patients with polyposis who had been prescribed preoperative oral corticosteroids.<sup>6</sup> These results are consistent with anecdotal experience that suggests that preoperative corticosteroid treatment of polyps makes their operative removal easier by reducing polyp size and vascularity.

To date there are no published studies that demonstrate efficacy of oral corticosteroid therapy in CRS without nasal polyposis. Animal sinusitis models have failed to show that the corticosteroid therapy reduced inflammation within the mucosa.<sup>7</sup> However clinical experience suggests that a number of patients with CRS without nasal polyposis appear to benefit from this treatment. This is most likely due to the clinical distinction between CRS with and without nasal polyps not being strictly clear cut, and so it remains a very valid option to prescribe a trial course of corticosteroids to patients with CRS without nasal polyposis.

#### Topical antibiotics

Although the role of biofilms in the pathogenesis of CRS still remains unclear, their observation in many cases of CRS has prompted research into the possible therapeutic role of topical antibiotics. *In vitro* and animal models have demonstrated that both topical mupirocin<sup>8</sup> and moxifloxacin<sup>9</sup> lead to a marked reduction of biofilm surface area coverage compared to saline, surfactant and combination therapies. The only *in vivo* study is a small pilot study where 16 patients with recalcitrant CRS even post-FESS, with confirmed *Staphylococcus aureus* culture on nasal swabs, were treated with topical mupirocin with significant reduction in symptoms.<sup>10</sup> Further research is required into demonstrating the effect of topical antibiotics on biofilm surface area reduction, and its implications on the reported symptoms of CRS in the clinical setting.

#### Oral antibiotics

Oral antibiotics are frequently prescribed for CRS, particularly for acute exacerbations. There are several studies that demonstrate long-term courses of macrolide antibiotics result in improvement in CRS symptoms and patient quality of life, and there appears to be no significant difference on the effect of long-term macrolide antibiotics between CRS patients with or without nasal polyposis.<sup>11</sup> There is ongoing debate whether this effect is due to the antibiotic or anti-inflammatory actions of macrolides.

Doxycycline, an antibiotic to which anti-inflammatory effects have also been attributed, has been investigated in CRS patients and a reduction in myeloperoxidase, eosinophil cationic protein and matrix metalloproteinase has been shown in nasal secretions.<sup>5</sup> This study also showed a significant reduction in nasal polyp size, nasal symptoms and inflammatory markers. It may be speculated that preoperative macrolide or tetracycline therapy could improve operating field and possibly outcome, but there is currently no evidence on the impact of courses of preoperative antibiotics on intra- or post-operative progress.

The culturing of *Staphylococcus aureus* intraoperatively has been shown to be associated with worse surgical outcomes.<sup>12</sup> Accordingly, preoperative eradication of microorganisms within the sinonasal cavity may be therapeutically helpful but there is not yet consensus on how best to achieve this. Some trials have focused specifically on skin and mucosal decolonization, especially of methicillin-resistant *Staphylococcus aureus*, and these regimens appear to be successful, at least in the short-term. Whether long-term clearance of staphylococcal carriage can be achieved is not clear.

#### Nasal lavage

Saline irrigation of the sinonasal cavities has been shown to bring symptoms relief to both patients with or without nasal polyposis.<sup>1</sup> The technique is safe as well as being relatively convenient to use. Further research is underway as to the tonicity of the saline used, as well as various additives that may be used in conjunction with saline. There are no data of the effect of perioperative saline lavage on postoperative course

### Postoperative Wound Care

The aim of sinus surgery is to remove diseased tissue, simplify sinus anatomy and widen natural ostia. Re-mucosalization of the sinonasal cavities is critical in the immediate postoperative healing phase.

Intra and postoperative antibiotics may reduce micro-organism load and decrease the possibility of postoperative infections.

Intranasal clots act as scaffolding for fibrosis and scarring. Intraoperative haemostasis may be improved by application of topical tranexamic acid, and evidence of its efficacy has been reported in a blinded randomized study comparing tranexamic acid and epsilon-aminocaproic acid.<sup>13</sup>

There has also been extensive research into the various forms of nasal packing, but as yet there is no agreement on the optimal method of creating a clot-free environment for re-mucosalization to occur. Traditional removable packing materials have been associated with pain and discomfort as well as additional trauma to the mucosa during removal, and the current thinking supports the use of a dressing that is absorbable and haemostatic and improves healing. Development of dressings such as microporous polysaccharide haemospheres and chitosan gel may prove to be effective,<sup>14</sup> but long-term follow-up data are not yet available.

## Post-Operative Medical Therapy

### *Tranexamic acid*

Post-FESS bleeding and the subsequent clotting within the sinonasal cavity may lead to scarring and adhesion formation. An oral course of tranexamic acid, for 5 days starting from 2 hours prior to surgery, has been shown to significantly reduce postoperative bleeding.<sup>15</sup>

### *Topical corticosteroids*

Topical corticosteroid sprays have been advocated post-polypectomy for in an attempt to reduce polyp recurrence since the 1980s. In a study that followed patients for five years post-operatively, better endoscopic oedema and polyp scores and total nasal volumes were seen in those patients given a six week topical fluticasone course postoperatively, compared to the placebo group. It was also found that significantly more prednisolone rescue medication courses were prescribed in the placebo group during the follow-up period.<sup>16</sup> There is as yet no published evidence of benefit of using topical corticosteroid sprays after FESS in patients without polyposis.

### *Oral steroids*

There have been no randomized controlled trials specifically assessing the efficacy of postoperative systemic steroid use for nasal polyposis, but the consensus is that a short course of high dose prednisone is helpful in many cases.<sup>1</sup> In a group of allergic fungal sinusitis patients, a randomised, placebo-controlled trial demonstrated a 12 week postoperative tapering course of prednisone resulted in significant subjective and objective improvements and reduced early recurrence.<sup>17</sup>

### *Antibiotics*

An intraoperative finding of pus or overt infection within the sinuses has been associated with worse surgical outcome and the use of culture-directed short-term antibiotic would seem logical although there is limited clinical evidence supporting the use of post-operative antibiotics. A randomised, placebo-controlled study involving 71 patients demonstrated that patient's symptom scores, the general short-term outcome of FESS, and bacterial culture growth rate were not changed by a course of postoperative antibiotics.<sup>18</sup>

### *Nasal douche*

It is routine in many units to prescribe patients regular high volume low pressure saline irrigation of the sinonasal cavities, in order to achieve a moist, clot-free healing environment. There is no controlled trial that demonstrates the impact of saline irrigation on outcome post FESS. However, irrigation provides a gentle method of debridement of clot and crusts, and anecdotal evidence strongly supports its use.

### *Aspirin desensitization*

Samter's triad consists of a combination of nasal polyposis, asthma and aspirin hypersensitivity. Although it would appear paradoxical, there is evidence that desensitization and long-term treatment with daily aspirin reduces nasal symptoms and polyp recurrence, and therefore a need for reoperation, in patients with Samter's triad.<sup>19</sup> The requirement for desensitization and supervision of its administration is best overseen by a clinical immunologist.

### *Antileukotrienes*

There is evidence of increased leukotriene synthesis and release in nasal polyp tissue, providing theoretical justification for the use of leukotriene antagonists in this condition. Although some report a significant improvement in nasal symptoms in CRS patients with or without polyps with therapy targeted at leukotriene production, a double-blinded study showed no significant difference in outcome between treatment with montelukast (a leukotriene receptor antagonist) or a topical corticosteroid spray at one year post surgery.<sup>20</sup>

## Conclusion

CRS is a disease characterized by mucosal inflammation and so endoscopic sinus surgery must be supported by perioperative therapies that aim to reduce mucosal inflammation if the outcome of surgery is to be optimized. There are surprisingly few trials of perioperative medical therapy for FESS and the major findings of these have been summarized in the review above. Below we will describe briefly how we have translated these studies and the weight of anecdotal evidence into a set of recommendations.

Patients with CRS have a trial of medical therapy, which includes three weeks of prednisone and antibiotics and three months of nasal saline lavage and topical corticosteroid spray. Those patients who do not respond sufficiently to this regimen are offered surgery.

Preoperative prednisolone and antibiotics are not given routinely, but only to those patients with unstable asthma or severe nasal polyposis. At induction all patients receive intravenous dexamethasone and cefazolin. Anaesthetic agents are administered intravenously (propofol and remifentanyl) and intraoperative hypotension and bradycardia are maintained if possible. Intravenous tranexamic acid is given if the bleeding remains troublesome despite systemic hypotension and topical vasoconstriction.

Postoperatively, all patients begin nasal saline lavage with the *Sinus Rinse* device (2 bottles QID), topical corticosteroid sprays and oral antibiotics (doxycycline 100mg BD for between two and four weeks). The frequency of saline lavage is gradually reduced postoperatively to twice daily, but it is suggested that patients continue to lavage and use corticosteroid sprays indefinitely to reduce the rate of late relapse.

Patients with nasal polyps are given a three-week reducing dose course of prednisolone. Patients with Samter's triad are started on montelukast 10 mg daily immediately postoperatively and are desensitized to aspirin a week or two postoperatively.

**Declaration of competing interests:** nothing to declare.

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