Background: The body of knowledge regarding rhinosinusitis (RS) continues to expand, with rapid growth in number of publications yet substantial variability in the quality of those presentations. In an effort to both consolidate and critically appraise this information, rhinologic experts from around the world have produced the International Consensus Statement on Allergy and Rhinology: Rhinosinusitis (ICAR:RS). This executive summary consolidates the findings of the ICAR:RS document.

Methods: ICAR:RS presents over 140 topics in the forms of evidence-based reviews with recommendations (EBRRs) and evidence-based reviews (EBR). The structured recommendations of the EBRR sections are summarized in this executive summary.

Results: This summary compiles the EBRRs regarding medical and surgical management of acute RS (ARS) and chronic RS with and without nasal polyps (CRSwNP and CRSsNP).

Conclusion: This ICAR:RS Executive Summary provides a compilation of the evidence-based recommendations for medical and surgical treatment of the most common forms of RS. © 2016 ARS-AAOA, LLC.

Key Words: rhinosinusitis; chronic rhinosinusitis; acute rhinosinusitis; recurrent acute rhinosinusitis; evidence-based medicine; systematic review; endoscopic sinus surgery


I. Introduction

The body of knowledge regarding rhinosinusitis (RS) continues to expand, with rapid growth in number of publications yet substantial variability in the quality of those presentations. In an effort to both consolidate and critically appraise this information, rhinologic experts from around the world have produced the International Consensus Statement on Allergy and Rhinology: Rhinosinusitis (ICAR:RS).1

The ICAR:RS document addresses over 140 topics in RS, including acute RS (ARS), chronic RS with and without nasal polyps (CRSwNP and CRSsNP), recurrent acute RS (RARS), acute exacerbation of CRS (AECRS), and pediatric RS. ICAR:RS follows the methodology that has produced a number of rhinologic evidence-based reviews with recommendations (EBRRs) in the International Forum of Allergy and Rhinology. Using this structured methodology, ICAR:RS represents a robust review of the current evidence and also provides management recommendations based on the best available evidence.

ICAR:RS is thus much more than a literature review or a report of a consensus panel of experts. The use of systematic reviews and semi-anonymous contributions to and critiques of the manuscript minimizes the impact of “expert opinion” and other potential biases. It should be remembered, however, that ICAR:RS is also not a “cookbook” for how to treat RS patients. Just like a more rigorous clinical practice guideline, it is a summary of the best available evidence, with recommendations that arise from that best evidence. Healthcare providers must adapt these recommendations to individual patients and clinical situations.

As a critical review of the RS literature, ICAR:RS also plainly demonstrates the significant gaps in our understanding of the pathophysiology and optimal management of RS. Too often the foundation upon which these recommendations are based is comprised of lower level evidence.

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It is our hope that this summary of the evidence in RS will point out where additional research efforts can be directed.

II. Methods
Each of 144 topics in RS was assigned to 1 of 76 rhinology experts worldwide. The amount of evidence in any given topic varied such that a few were assigned as literature reviews. The remaining topics that had substantial evidence were assigned as EBRRs or as evidence-based reviews only (EBRs), if they did not lend themselves to providing a recommendation, such as those addressing diagnosis and pathogenesis.

For EBRs and EBRRs, the methodology of Rudmik and Smith was followed for each of these sections. Briefly, a systematic review was performed with grading of all evidence. An initial author drafted a summary of the evidence, with an aggregate evidence grade and, where applicable, a structured recommendation. A multistage online semi-blinded iterative review process then refined each section. Following this thorough EBR and EBRR development and review with 3 to 4 rhinologists for each topic, the section manuscripts were then combined into a cohesive single document. The entire manuscript was then reviewed by all authors for consensus.

III. Results
The resulting ICAR:RS document addresses a number of significant areas, including:

1. Definitions and diagnostic criteria for the various forms of RS.
2. Presentation of the burden of RS, both at the societal and individual level.
3. A thorough review of the potential pathophysiologic mechanisms for the various forms of RS.
4. Recommendations for diagnosis and treatment of the various manifestations of RS, including cost-effective evaluation of the CRS patient. The structured recommendations are listed below.
5. Evaluation of the efficacy of endoscopic sinus surgery (ESS) in improving quality of life in CRS patients. An evidence-based regimen for appropriate medical therapy prior to considering surgery is provided. Structured recommendations regarding preoperative and postoperative care as well as intraoperative technique are listed below.

III.A. Results: Definitions and Diagnostic Criteria
RS in adults is divided and defined based on the temporal course of its manifestation (Table III-1).

Subacute RS is a term used to describe RS when it lasts greater than 4 weeks but less than 12 weeks. Its clinical features fall somewhere between ARS and CRS. Use of this classification should be limited until a better understanding of this condition is achieved.

### Table III-1. Definitions and diagnostic criteria for rhinosinusitis

<table>
<thead>
<tr>
<th>Condition</th>
<th>Definition and diagnostic criteria</th>
</tr>
</thead>
</table>
| **Acute rhinosinusitis (ARS)**   | Sinonasal inflammation lasting less than 4 weeks associated with the sudden onset of symptoms. Symptoms must include both:
|                                  | • nasal blockage/obstruction/congestion OR nasal discharge (anterior/posterior) AND
|                                  | • facial pain/pressure OR reduction/loss of smell. Radiology and endoscopy are not required for diagnosis. |
| **Chronic rhinosinusitis (CRS)** | Sinonasal inflammation persisting for more than 12 weeks. Symptoms must include at least 2 of the following:
|                                  | • nasal blockage/obstruction/congestion
|                                  | • nasal discharge (anterior/posterior)
|                                  | • facial pain/pressure
|                                  | • reduction/loss of smell
|                                  | Additionally, the diagnosis must be confirmed by:
|                                  | • Evidence of inflammation on paranasal sinus examination or computed tomography (CT)
|                                  | • Evidence of purulence coming from paranasal sinuses or ostiomeatal complex
|                                  | CRS is divided into CRSwNP or CRSSNP based on the presence or absence of nasal polyps. |
| **Recurrent acute rhinosinusitis (RARS)** | Four or more episodes of ARS per year with distinct symptom-free intervals between episodes. Each episode must meet the above criteria for ARS |
| **Acute exacerbation of chronic rhinosinusitis (AECRS)** | Sudden worsening of CRS symptoms with a return to baseline symptoms following treatment |

CRSsNP = CRS without nasal polyps; CRSwNP = CRS with nasal polyps.

III.B. Results: The Burden of RS
We increasingly understand the significant burden of RS, both at a societal and at an individual level. The ICAR:RS document thoroughly reviews this literature, including direct and indirect costs as well as the substantial effect on individual well-being. Notable findings are an individual direct cost of US$770 to US$1220 per patient-year for CRS and a RS-related work productivity cost that approaches US$4 billion in the United States annually. At the individual level, the impact is also found to be substantial. Overall CRS quality of life is worse than that of individuals with congestive heart failure, chronic obstructive pulmonary
disorder, and Parkinson’s disease. RS has a large impact beyond the sinonasal region, with extrasinus manifestations such as fatigue, poor sleep quality, bodily pain, and depression reported in a large proportion of patients.

III.C. Results: Pathophysiology: Evidence of Contributing Factors

The ICAR:RS authors performed thorough evidence-based systematic reviews for all major proposed mechanisms for RS development. These reviews are summarized below.

ARS

- **Anatomic Variants:** The evidence for an association between ARS and anatomic variants is weak and largely inferred from studies on RARS, CRS, and mixed groups of RS. Aggregate Grade of Evidence: C (Level 4: 16 studies).
- **Allergy:** Observational studies provide a modest level of evidence supporting a relationship between allergic rhinitis (AR) and ARS. This is further supported by basic science evidence. There is some evidence that AR increases the likelihood of orbital complications of ARS but no evidence that AR prolongs the duration of ARS. Aggregate Grade of Evidence: C (Level 1b: 1 study; Level 2a: 2 studies; Level 2b: 1 study; Level 3a: 2 studies; Level 3b: 1 study).
- **Septal Deviation:** The role of septal deviation in ARS is unknown.
- **Viruses:** Viral rhinosinusitis is thought to precede acute bacterial RS (ABRS). Bacterial infection is more likely with duration of symptoms greater than 10 days, largely based on the probability of confirming a bacterial infection by sinus aspiration following 10 days of symptoms in addition to the natural time course for a spontaneous rhinovirus infection. It is important to understand that a bacterial infection could potentially occur at any time during the illness. Aggregate Grade of Evidence: C (Level 2b: 1 study; Level 3b: 1 study; 8 Level 4: 8 studies).
- **Odontogenic Infections:** The current literature demonstrates an absence of a well-designed and published investigation into the role of odontogenic infections in ARS. Currently, our understanding of odontogenic ARS is based on low-level evidence. Aggregate Grade of Evidence: C (Level 4: 6 studies).

CRSsNP

- **Allergy:** Evidence for allergy as a contributing factor in CRSsNP is level D. Allergy testing is considered an option in CRSsNP due to the small amount of potential harm and the possibility of identifying inflammatory triggers. Aggregate Grade of Evidence: D (Conflicting epidemiologic data [Level 1b: 1 small study; Level 3b: 7 studies; Level 4: 1 study], expert opinion, and reasoning from first principles).
- **Biofilms:** There is insufficient clinical evidence to determine a role.
- **Fungus:** Current evidence casts doubt on fungus as a primary etiologic factor in CRS (both CRSsNP and CRSwNP). Fungus may play a role in some subtypes of CRS, such as allergic fungal rhinosinusitis. Aggregate Grade of Evidence: C (Level 3: 7 studies; Level 4: 2 studies).
- **Osteitis:** Osteitis appears to be associated with refractory CRS but no cause-and-effect relationship has been demonstrated. Aggregate Grade of Evidence: C (Level 1b: 1 study; Level 2b: 5 studies; Level 3a: 5 studies; Level 3b: 13 studies).
- **Reflux:** There is significant evidence demonstrating a coexistent relationship between reflux and CRS (both CRSsNP and CRSwNP), although causation cannot be clearly demonstrated. It is not entirely clear with the evidence currently available whether extraesophageal reflux of gastric acid directly injures the sinonasal mucosa, whether reflux events cause vagally-mediated neuroinflammatory changes, or if it is a combination of both of these factors. Aggregate Grade of Evidence: B (Level 1b: 1 study; Level 2b: 6 studies; Level 4: 3 studies).
- **Vitamin D Deficiency:** Two statements can be made about Vitamin D in CRSsNP:
  1. CRSsNP is not associated with systemic vitamin D deficiencies. Aggregate Grade of Evidence: C (Level 3b: 4 studies); and
  2. Smoke exposure in CRSsNP patients can lower systemic and local vitamin D levels. Aggregate Grade of Evidence: C (Level 3b: 1 study).
- **Superantigens:** There is insufficient clinical evidence to determine a role.
- **Microbiome Disturbance:** There is insufficient clinical evidence to determine a role.
- **Anatomic Variation:** The evidence indicates anatomic variations may contribute to CRSsNP, although some of the data are conflicting and many studies do not differentiate between CRSsNP, CRSwNP, and ARS. Although there appears to be a causal association in some studies, sinus anatomical abnormalities do not likely play a large role in the pathogenesis of CRSsNP. Aggregate Grade of Evidence: C (Level 2b: 3 studies; Level 3b: 4 studies; Level 4: 7 studies). Results of studies are conflicting.
- **Septal Deviation:** Most studies are low-level and show an apparent limited effect. Additionally, definition heterogeneity limits drawing firm conclusions on the role of septal deviation in CRS. Aggregate Grade of Evidence: Grade C (Level 1b: 1 study; Level 3b: 3 studies; Level 4: 6 studies).
- **Innate Immunity:** In patients with CRSsNP, the data demonstrate that key innate immune mediators are differentially expressed. The current evidence is relatively sparse, with no cohesive picture yet forming.
- **Epithelial Barrier Disturbance:** There is insufficient clinical evidence to determine a role.
• **Ciliary Derangements:** There is insufficient clinical evidence to determine a substantial role.

• **Immunodeficiency:** Review of the literature demonstrates a potentially underappreciated role, especially in refractory cases. Primary immunodeficiency should be considered in patients with refractory CRS. Aggregate Grade of Evidence: C (Level 2b: 1 study; Level 3b: 8 studies; Level 4: 8 studies).

• **Genetic Factors:** Our understanding of the role of genetics in the pathogenesis of CRSsNP is in its infancy. The ICAR:RS document lists all genes that have been linked to CRS. Intriguing concepts continue to emerge that anticipate further exciting developments.

**CRSwNP**

• **Allergy:** Despite an overlap of immunologic pathways and of symptoms, conflicting data in the literature prevents definitive conclusion about the association between atopy and nasal polyposis. Well-designed, prospective studies with defined inclusion and exclusion criteria among defined populations would shed additional light on this relationship. Aggregate Grade of Evidence: D (Conflicting observational studies - case control and cohort design).

• **Biofilms:** There is insufficient clinical evidence to determine a role.

• **Fungus:** Combined with CRSsNP above.

• **Osteitis:** Combined with CRSsNP above.

• **Reflux:** Combined with CRSsNP above.

• **Vitamin D Deficiency:** Available evidence indicates that vitamin D deficiency is common in CRSwNP and correlates with severity of mucosal and bone disease in CRSwNP. Aggregate Grade of Evidence: C (Level 2: 5 studies; Level 4: 1 study).

• **Superantigens:** Based on a wealth of in vitro and some clinical data, superantigens appear to have a significant role in the pathogenesis of CRSsNP.

• **Microbiome Disturbance:** There is insufficient clinical evidence to determine a role.

• **Anatomic Variation:** The relationship between anatomical variants and development of disease in patients with CRSwNP is impossible to ascertain given our current literature and understanding of this inflammatory disease. Studies that independently evaluate this group of patients suggest minimal influence on pathophysiology and instead favor a systemic inflammatory process leading to sinonasal disease.

• **Septal Deviation:** Combined with CRSsNP above.

• **Innate Immunity:** There is conflicting data suggesting either an up or down regulation of expression of antimicrobial proteins, antimicrobial peptides and pattern recognition receptors in CRSwNP.

• **Epithelial Barrier Disturbance:** There is insufficient clinical evidence to determine a role.

• **Ciliary Derangements:** There is insufficient clinical evidence to determine a substantial role.

• **Immunodeficiency:** The evidence linking immunodeficiency to CRSwNP is contradictory. In an effort to uncover all possible etiologies, some experts have recommended testing for immunodeficiency in refractory CRSwNP patients. Immunodeficiency testing is an option. Aggregate Grade of Evidence: C (Level 2: 1 study; Level 3b: 2 studies; Level 4: 3 studies).

• **Genetic Factors:** The genetic underpinnings of CRSwNP may differ from those of CRSsNP. Numerous genes have been implicated and are listed in the ICAR:RS document.

• **Aspirin Exacerbated Respiratory Disease:** Aspirin is a trigger of CRSwNP in select patients. Aggregate Grade of Evidence: D (Level 2a: 1 study; Level 2b: 3 studies; Level 5: 10 studies).

## III.D. Results: Evidence-Based Rhinosinusitis Management Recommendations

### ARS

Evidence-based recommendations for the management of ARS are summarized in Table III-2.

• **Antibiotics:** Although antibiotics have traditionally been prescribed for acute bacterial RS, this practice has recently been questioned. There is substantial evidence that ARS has a high spontaneous resolution rate and the adverse events and costs from adding antibiotics may outweigh any potential benefits. Four recent systematic reviews of randomized controlled trials (RCTs) found that antibiotics conferred a benefit but it was small, improving cure rates at 7 to 15 days from 86% with placebo to 91% with antibiotics.

  - Aggregate Grade of Evidence: A for choosing whether to prescribe antibiotics (Level 1a: 4 studies) B for amoxicillin vs amoxicillin-clavulanate (Level 1b: 2 studies; Level 2b: 2 studies; Level 4: 3 studies).
  - Benefit: Potential for shorter duration of symptoms; reduced pathogen carriage.
  - Harm: Gastrointestinal (GI) complaints greater than observed in placebo for both drugs, more pronounced for amoxicillin-clavulanate. Potential for resistance and for anaphylaxis.
  - Cost: Low to moderate.
  - Benefits-Harm Assessment: Benefit of treatment over placebo is small.
  - Value Judgments: Improvement in patient symptoms is limited with risk of adverse events. Patient preference may be strong and education regarding benefit-harm balance may be necessary.
  - Policy Level: Antibiotic use in suspected ABRS: Option. If an antibiotic is chosen, amoxicillin-clavulanate vs amoxicillin: Option.
  - Intervention: Withholding antibiotics with close follow-up is an option in suspected ABRS. If an antibiotic is chosen, both amoxicillin and amoxicillin-clavulanate are options for treatment of
### TABLE III-2. Summary of recommendations for ARS management

<table>
<thead>
<tr>
<th>Intervention</th>
<th>LOE</th>
<th>Benefit</th>
<th>Harm</th>
<th>Cost</th>
<th>Benefit-harm assessment</th>
<th>Policy level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antibiotics (whether to prescribe)</td>
<td>A</td>
<td>Potential for shorter duration of symptoms; reduced pathogen carriage</td>
<td>GI complaints greater than observed in placebo for both drugs, more pronounced for amoxicillin-clavulanate. Potential for resistance and for anaphylaxis</td>
<td>Low to moderate</td>
<td>Benefit of treatment over placebo is small</td>
<td>Antibiotic use in suspected ABRS: Option</td>
</tr>
<tr>
<td>Antibiotics (choosing amoxicillin or amoxicillin-clavulanate)</td>
<td>B</td>
<td>Potential for shorter duration of symptoms; reduced pathogen carriage</td>
<td>GI complaints greater than observed in placebo for both drugs, more pronounced for amoxicillin-clavulanate. Potential for resistance and for anaphylaxis</td>
<td>Low to moderate</td>
<td>Benefit of treatment over placebo is small</td>
<td>If an antibiotic is chosen, amoxicillin-clavulanate vs amoxicillin: Option</td>
</tr>
<tr>
<td>Corticosteroids (nasal [INCS] and systemic)</td>
<td>A</td>
<td>INCS improved patient symptoms as monotherapy or adjuvant to antibiotics in severe cases, and hastened recovery; Systemic minimal benefit</td>
<td>Minimal harm with rare mild adverse event</td>
<td>Low</td>
<td>Benefit of treatment over placebo small, but tangible; minimal harm with INCS, greater risk for prolonged systemic corticosteroids</td>
<td>Use of INCS: Strong recommendation. Use of systemic corticosteroid: No recommendation</td>
</tr>
<tr>
<td>Decongestants</td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
<td>Insufficient evidence for a recommendation</td>
<td></td>
</tr>
<tr>
<td>Antihistamines</td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
<td>Insufficient evidence for a recommendation</td>
<td></td>
</tr>
<tr>
<td>Nasal saline irrigation</td>
<td>A</td>
<td>Possible nasal symptom improvement. Improved saccharin transit times</td>
<td>Occasional patient discomfort</td>
<td>Minimal</td>
<td>Benefit likely to outweigh harm</td>
<td>Option</td>
</tr>
</tbody>
</table>

ABRS = acute bacterial rhinosinusitis; GI = gastrointestinal; INCS = intranasal corticosteroids; LOE = level of evidence; N/A = not applicable.

uncomplicated ARS. Consider amoxicillin-clavulanate for potentially complicated infection or when resistant organisms are suspected.

- **Intranasal Corticosteroids and Systemic Corticosteroids:** With infrequent adverse events and limited systemic uptake, intranasal corticosteroid (INCS) use in ARS is a recommendation with grade A aggregate quality of evidence. Additional studies comparing ideal INCS formulation, dose, and timing will provide important insight into tailoring INCS treatment in ARS. Studies that have looked at systemic corticosteroid therapy in ARS have used heterogeneous methods and had varying results. Given the lack of clear benefit and substantial risk of harm, systemic corticosteroids in cases of uncomplicated ARS are not recommended, with a grade B aggregate quality of evidence.
  - **Aggregate Grade of Evidence:** A (Level 1a: 7 studies; Level 1b: 11 studies).
  - **Benefit:** INCS improved patient symptoms as monotherapy or adjuvant to antibiotics in severe cases, and hastened recovery; Systemic minimal benefit.
  - **Harm:** Minimal harm with rare mild adverse event.
  - **Cost:** Low for both interventions.
  - **Benefits-Harm Assessment:** Benefit of treatment over placebo small, but tangible; minimal harm with INCS, greater risk for prolonged systemic corticosteroids.
  - **Value Judgments:** INCS improved patient symptoms with low risk for adverse event.
  - **Policy Level:** Use of INCS: Strong recommendation. Use of systemic corticosteroid: No recommendation.
Evidence-based recommendations for the management of recurrent acute rhinosinusitis are summarized in Table III-3.

- **Intranasal Corticosteroids (INCS)**: Three double-blinded RCTs (DBRCTs) have been published, with the primary objective of assessing the effect of INCS on symptom outcomes of patients with RARS. All studies reported improvement in symptoms in the treatment groups.
  - **Aggregate Grade of Evidence**: B (Level 2b: 3 studies).
  - **Benefit**: Generally well tolerated. May decrease time to symptom relief. May decrease overall symptom severity, as well as specific symptoms of headache, congestion, and facial pain.
  - **Harm**: Mild irritation.
  - **Cost**: Moderate depending on preparation.
  - **Benefits-Harm Assessment**: Balance of benefit and harm.

- **Antibiotics**: Uncomplicated ARS in patients with RARS should be prescribed antibiotics based on the same criteria used to manage primary or sporadic episodes of ARS. After performing an exhaustive review of the literature, there are no available data to provide additional recommendations for the use of antibiotics in RARS different from recommendations for treating ABRS.
- **Endoscopic Sinus Surgery (ESS)**: Three noncomparative studies have examined this issue and found improvement following ESS. The lower level of evidence in these studies weakens the recommendation to an option.
  - **Aggregate Grade of Evidence**: C (Level 3b: 3 studies; Level 4: 1 study).
  - **Benefit**: Postoperative improvement in patient symptoms. May reduce postoperative antibiotic utilization, number of acute episodes, and missed workdays. Results appear comparable to CRS cohorts.
  - **Harm**: Surgery is associated with potential complications.
  - **Cost**: Significant costs are associated with ESS.
  - **Benefits-Harm Assessment**: Balance of benefit and harm.
  - **Value Judgments**: Properly selected patients with RARS may benefit both symptomatically and medically from ESS. This option should be assessed and utilized cautiously, however, because data remain limited.
  - **Policy Level**: Option.
  - **Intervention**: ESS is an option for properly selected patients with RARS.

**Recurrent Acute Rhinosinusitis**

Evidence-based recommendations for the management of recurrent acute rhinosinusitis are summarized in Table III-3.

**Chronic Rhinosinusitis - Diagnosis**

- **Cost Effective Diagnostic Workup**: Prior evidence-based reviews have generally lacked recommendations for the cost-effective diagnosis of adult CRS. Since 1997, expert groups on RS have proposed different diagnostic criteria for RS, with varying combinations of symptoms and symptom duration, but more recent iterations require confirmation with CT imaging or endoscopy to arrive at a CRS diagnosis. ICAR:RS examined the published data on arriving at a correct diagnosis using symptoms alone and symptoms plus either nasal endoscopy or diagnostic imaging.
- **CRS Diagnosis Using Symptoms Alone**
  - **Aggregate Grade of Evidence**: B (Level 2b: 8 studies; Level 4: 2 studies).
### TABLE III-3. Summary of recommendations for RARS management

<table>
<thead>
<tr>
<th>Intervention</th>
<th>LOE</th>
<th>Benefit</th>
<th>Harm</th>
<th>Cost</th>
<th>Benefit-harm assessment</th>
<th>Policy level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intranasal corticosteroids</td>
<td>B</td>
<td>May decrease time to symptom relief and overall symptom severity</td>
<td>Mild irritation</td>
<td>Moderate</td>
<td>Balance of benefit and harm</td>
<td>Option</td>
</tr>
<tr>
<td>Antibiotics</td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Endoscopic sinus surgery</td>
<td>C</td>
<td>Improvement in patient symptoms, antibiotic use</td>
<td>Risk of surgery-related complication</td>
<td>Significant</td>
<td>Balance of benefit and harm</td>
<td>Option</td>
</tr>
</tbody>
</table>

ARS = acute rhinosinusitis; LOE = level of evidence; N/A = not applicable; RARS = recurrent acute rhinosinusitis.

- **Benefit:** A “symptoms alone” strategy is a patient-centered and widely available means for establishing possible diagnosis of CRS.
- **Harm:** High rate of false-positive diagnoses may prevent or delay the establishment of correct underlying diagnoses and potential for inappropriate interventions resulting in direct and indirect healthcare costs (e.g., time lost from work and potential adverse effects from treatments).
- **Cost:** Low-performed at all specialist and nonspecialist visits.
- **Benefits-Harm Assessment:** Harm over benefit, if used as the sole clinical method for CRS diagnosis, as there is a significant risk of misdiagnosis.
- **Value Judgments:** Assessing patient reported symptoms is an important component of the patient encounter, but is too inaccurate to be the only means used to diagnose CRS.
- **Policy Level:** Recommend against.
- **Intervention:** Recommendation against using a “symptoms-alone” strategy to make the diagnosis of CRS.

**CRS Diagnosis with Nasal Endoscopy**

- **Aggregate Grade of Evidence:** B (Level 2a: 1 study; Level 2b: 3 studies).
- **Benefit:** Higher positive predictive value and specificity for a CRS diagnosis compared to using symptoms alone, allowing for the avoidance of CT utilization costs and potential radiation exposure of imaging.
- **Harm:** If the clinician still suspects CRS, a negative endoscopy exam will still require a CT scan of the sinuses due to the potential for a false-negative endoscopy. Mild discomfort associated with the procedure.
- **Cost:** For 2014, the Centers for Medicare & Medicaid Services (CMS) in the United States set a national payment average for a diagnostic nasal endoscopy (Current Procedural Terminology 31231) at US$212.07, which accounts for both service and facility reimbursements for the diagnostic intervention. This cost reflects the specialists’ time to perform and review findings of endoscopy, capital needed to purchase the essential equipment, and expenses related to sterilizing and maintaining the endoscopes.
- **Benefits-Harm Assessment:** Preponderance of benefit as the initial technique to objectively establish CRS diagnosis by trained endoscopists, but the technique is limited by a reduced sensitivity relative to CT imaging.
- **Value Judgments:** Endoscopy is an important diagnostic intervention that should be used in conjunction with a thorough history and physical exam for patients suspected of having CRS. It should be complemented with other diagnostic testing in the event of a negative endoscopy where CRS is still suspected.
- **Policy Level:** Recommendation.
- **Intervention:** Nasal endoscopy is recommended in conjunction with a history and physical examination for a patient being evaluated for CRS. CT is an option for confirming CRS instead of nasal endoscopy.

**CRS Workup with Diagnostic Imaging**

- **Aggregate Grade of Evidence:** B (Level 1b: 1 study, Level 2c: 2 studies).
- **Benefit:** CT imaging is more sensitive than nasal endoscopy, and obtaining imaging earlier in the diagnostic algorithm reduces antibiotic utilization.
- **Harm:** Concerns regarding radiation exposure.
- **Cost:** For 2014, the CMS-based national average payment for CT imaging without contrast material of the maxillofacial area (Current Procedural Terminology code 70486) was US$208.85. This reimbursement fee for CT imaging accounts for costs for capital equipment, technical execution of the scan.
and the professional fee associated with interpretation of the CT scan.

- **Benefits-Harm Assessment**: Variable, dependent on the pre-test likelihood of disease, access to CT scan, and findings of physical exam and endoscopy.
- **Value Judgments**: A patient’s history of radiation exposure and preferences should be taken into account when deciding to confirm CRS with CT. Nasal endoscopy is another method of confirming CRS but is less sensitive and cannot delineate anatomy for surgical planning.
- **Policy Level**: Recommendation.
- **Intervention**: CT scanning is recommended for all levels of recommendation.

### Evidence

A (Level 1a: 1 study; Level 2a: 1 study; Level 2b: 4 studies)

#### Saline Irrigation

- **Benefit**: Improved QoL, symptoms, and endoscopic appearance. Well tolerated. No risk of systemic adverse effects. Low cost.
- **Harm**: Local irritation, nasal burning, headaches, and ear pain/congestion. Low risk of infection from contamination.
- **Cost**: Minimal (US$0.24/day). Patient time for application.
- **Benefits-Harm Assessment**: Preponderance of benefit over harm.
- **Value Judgments**: Important to use nasal saline irrigation as an adjunct to other topical therapy strategies. Higher-volume (>200 mL) irrigations appear to be superior to low-volume nasal saline spray techniques.
- **Policy Level**: Recommend.
- **Intervention**: High-volume (>200 mL) nasal saline irrigations are recommended as an adjunct to other medical therapies for CRS.

#### Topical Corticosteroids

**Standard Delivery (Sprays)**

INCS has excellent support in the literature for its use in CRS, with evidence of benefit and low risk of harm. The summary for CRSsNP follows:

- **Aggregate Grade of Evidence**: A (Level 1a: 2 studies; Level 1b: 2 studies).
- **Benefit**: Improved symptom scores, improved endoscopic scores.
- **Harm**: Epistaxis, headache.
- **Cost**: Low to moderate (US$0.61 to US$4.80 per day depending on medication).
- **Benefits-Harm Assessment**: Preponderance of benefit over harm.
- **Value Judgments**: Direct sinus delivery methods showed greater effects on symptom scores, therefore should be considered in more complex cases of CRS, or following failure of treatment with simple sprays.
- **Policy Level**: Recommendation.
- **Intervention**: Standard metered dose INCS should be used in treatment of CRSsNP.

For CRSwNP, the evidence is strong as well:

- **Aggregate Grade of Evidence**: A (Level 1b: 36 studies; Level 2b: 4 studies).
- **Benefit**: Improved symptoms, endoscopic appearances, polyp size, and QoL, objective tests of olfaction, and airway and polyp recurrence.
- **Harm**: Epistaxis, nasal irritation, headache.
- **Cost**: Moderate depending on preparation
- **Benefits-Harm Assessment**: Benefit outweighs harm.
- **Value Judgments**: None.
- **Policy Level**: Recommended.
- **Intervention**: Topical nasal corticosteroids (sprays or drops) are recommended for CRSwNP before or after sinus surgery.

#### Topical Corticosteroids–Nonstandard Delivery

- **Benefit**: Improved subjective symptom scores and endoscopic appearance in postoperative patients. MAD - Improvement in HR-QoL, subjective symptom scores and endoscopic appearance in postoperative patients. MAD - Improvement in HR-QoL.
- **Harm**: Irradiations - minor (epistaxis, nasal irritation). No evidence of adrenal suppression at studied doses. MAD - Trend toward reduced stimulated...
TABLE III-4. Summary of recommendations for CRSsNP management

<table>
<thead>
<tr>
<th>Intervention</th>
<th>LOE</th>
<th>Benefit</th>
<th>Harm</th>
<th>Cost</th>
<th>Benefit-harm assessment</th>
<th>Policy level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saline irrigation</td>
<td>A</td>
<td>Improved symptomatic, radiologic, and endoscopic outcomes</td>
<td>Local irritation, nasal burning, headaches, and ear discomfort</td>
<td>Minimal</td>
<td>Preponderance of benefit over harm</td>
<td>Recommended</td>
</tr>
<tr>
<td>Topical corticosteroids (standard delivery)</td>
<td>A</td>
<td>Improved symptoms and endoscopic appearance</td>
<td>Epistaxis, headache</td>
<td>Low to moderate</td>
<td>Benefits outweigh harm</td>
<td>Recommended</td>
</tr>
<tr>
<td>Topical corticosteroids (nonstandard delivery)</td>
<td>B-C</td>
<td>Improvement in symptoms and endoscopic appearance</td>
<td>Epistaxis, nasal irritation, possible systemic absorption</td>
<td>Moderate to high, depending on method</td>
<td>Varies by method</td>
<td>Irigation, mucosal atomization, and maxillary sinus tube are options. YAMIK catheter is recommended against</td>
</tr>
<tr>
<td>Oral corticosteroids</td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
<td>Insufficient evidence for a recommendation</td>
<td></td>
</tr>
<tr>
<td>Antibiotics: oral nonmacrolide</td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
<td>Insufficient evidence for a recommendation</td>
<td></td>
</tr>
<tr>
<td>Antibiotics: oral macrolide</td>
<td>B</td>
<td>Reduction in endoscopy scores and some symptoms</td>
<td>Significant potential for medication interactions. Rare adverse events</td>
<td>Low</td>
<td>Benefits appear to outweigh harm</td>
<td>Option</td>
</tr>
<tr>
<td>Antibiotics: intravenous</td>
<td>C</td>
<td>Possible symptom improvement</td>
<td>Thrombophlebitis, neutropenia, sepsis, deep vein thrombosis, elevated liver enzymes, drug adverse events, rash, bleeding</td>
<td>High</td>
<td>Risks outweigh benefits</td>
<td>Recommendation against</td>
</tr>
<tr>
<td>Antibiotics: topical</td>
<td>B</td>
<td>None demonstrated in randomized trials</td>
<td>Local irritation, possible systemic absorption</td>
<td>Moderate to high</td>
<td>Harm outweighs benefits</td>
<td>Recommended against</td>
</tr>
<tr>
<td>Antifungals: topical</td>
<td>A</td>
<td>None demonstrated in randomized trials</td>
<td>Local irritation (rare)</td>
<td>Moderate</td>
<td>Harm outweighs benefits</td>
<td>Recommended against</td>
</tr>
<tr>
<td>Surfactants, Manuka honey, xylitol</td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
<td>Insufficient evidence for a recommendation</td>
<td></td>
</tr>
<tr>
<td>Colloidal silver</td>
<td>N/A</td>
<td></td>
<td>Significant safety concerns</td>
<td></td>
<td>Recommended against</td>
<td></td>
</tr>
</tbody>
</table>

CRSsNP = chronic rhinosinusitis without nasal polyps; LOE = level of evidence; N/A = not applicable.

cortisol levels. MAST - Invasive insertion, epistaxis. YAMIK - Patient discomfort, epistaxis.

- **Cost:** Moderate to High (from US$2.50 per day for budesonide respules, MAST tube US$100 for each tube + variable costs associated with insertion).

- **Benefits-Harm Assessment:** Irrigations - Preponderance of benefit over harm, with relatively high cost. MAD - Balance of benefit and harm. MAST - Balance of benefit and harm. YAMIK - Limited evidence shows preponderance of harm over benefit.

- **Value Judgments:** Early evidence for irrigations is low level and there is a higher cost compared to sprays. Stronger evidence of improvement is seen in postoperative patients.

- **Policy Level:** Irrigations - Option in postoperative patients. MAD - Option. MAST - Option. YAMIK - Recommendation against.

- **Intervention:** Corticosteroid nasal irrigations are an option in CRSsNP. They may be most beneficial in postoperative patients. The use of MAD or MAST is an option. Use of the YAMIK device is not recommended based on current evidence.
## TABLE III-5. Summary of recommendations for CRSwNP management

<table>
<thead>
<tr>
<th>Intervention</th>
<th>LOE</th>
<th>Benefit</th>
<th>Harm</th>
<th>Cost</th>
<th>Benefit-harm assessment</th>
<th>Policy level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Saline irrigation</strong></td>
<td>A</td>
<td>Improved symptomatic, radiologic, and endoscopic outcomes</td>
<td>Local irritation, nasal burning, headaches, and ear discomfort</td>
<td>Minimal</td>
<td>Preponderance of benefit over harm</td>
<td>Recommended</td>
</tr>
<tr>
<td><strong>Topical corticosteroids (standard delivery)</strong></td>
<td>A</td>
<td>Improved symptoms and endoscopic appearance</td>
<td>Epistaxis, headache</td>
<td>Low to moderate</td>
<td>Benefits outweigh harm</td>
<td>Recommended</td>
</tr>
<tr>
<td><strong>Topical corticosteroids (nonstandard delivery)</strong></td>
<td>A</td>
<td>Difficult to assess based on current evidence</td>
<td>Possible systemic absorption</td>
<td>Moderate</td>
<td>Balance of benefit and harm</td>
<td>Option</td>
</tr>
<tr>
<td><strong>Oral corticosteroids</strong></td>
<td>A</td>
<td>Significant short-term improvements in subjective and objective measures</td>
<td>GI symptoms, transient adrenal suppression, insomnia, and increased bone turnover. All established corticosteroid risks exist, particularly with prolonged treatment</td>
<td>Low</td>
<td>Preponderance of benefit to harm in small, short-term follow-up and with use less than once every 2 years</td>
<td>Recommendation for short-term management. Longer-term or frequent use is not supported by the literature and carries an increased risk of harm</td>
</tr>
<tr>
<td><strong>Antibiotics: oral nonmacrolide</strong></td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
<td>Insufficient evidence for a recommendation</td>
<td></td>
</tr>
<tr>
<td><strong>Antibiotics: oral macrolide</strong></td>
<td>B</td>
<td>Reduction in endoscopy scores and some symptoms; benefit may be transient</td>
<td>Significant potential for medication interactions. Rare adverse events</td>
<td>Low</td>
<td>Benefits appear to outweigh harm</td>
<td>Option</td>
</tr>
<tr>
<td><strong>Antibiotics: intravenous</strong></td>
<td>C</td>
<td>Possible symptom improvement</td>
<td>Thrombophlebitis, neutropenia, sepsis, deep vein thrombosis, elevated liver enzymes, drug adverse events, rash, bleeding</td>
<td>High</td>
<td>Risks outweigh benefits</td>
<td>Recommendation against</td>
</tr>
<tr>
<td><strong>Antibiotics: topical</strong></td>
<td>B</td>
<td>None demonstrated in randomized trials</td>
<td>Local irritation, possible systemic absorption</td>
<td>Moderate to high</td>
<td>Harm outweighs benefits</td>
<td>Recommended against</td>
</tr>
<tr>
<td><strong>Antifungals: topical</strong></td>
<td>A</td>
<td>None demonstrated in randomized trials (may have some benefit in AFRS)</td>
<td>Local irritation (rare)</td>
<td>Moderate</td>
<td>Harm outweighs benefits</td>
<td>Recommended against</td>
</tr>
<tr>
<td><strong>Surfactants, Manuka honey, xylitol</strong></td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
<td>Insufficient evidence for a recommendation</td>
<td></td>
</tr>
<tr>
<td><strong>Colloidal silver</strong></td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
<td>Recommended against</td>
<td></td>
</tr>
<tr>
<td><strong>Antileukotrienes</strong></td>
<td>A</td>
<td>Improvement in symptoms</td>
<td>Limited risks</td>
<td>Moderate</td>
<td>Balance of benefit and harm</td>
<td>Option</td>
</tr>
<tr>
<td><strong>Aspirin desensitization (for AERD patients)</strong></td>
<td>B</td>
<td>Reduced polyp re-formation after surgery</td>
<td>Bleeding, gastrointestinal upset</td>
<td>High initial cost for desensitization benefit outweighs harm</td>
<td>Recommended for AERD patients</td>
<td></td>
</tr>
</tbody>
</table>

AERD = aspirin-exacerbated respiratory disease; AFRS = allergic fungal rhinosinusitis; CRSwNP = chronic rhinosinusitis without nasal polyps; GI = gastrointestinal; N/A = not applicable.
For CRSwNP, the evidence is stronger but the risk of systemic absorption cannot be entirely excluded based on current knowledge:

- **Aggregate Grade of Evidence:** B (Level 1b: 1 study; Level 4: 5 studies).
- **Benefit:** Overall not possible to statistically confirm therapeutic improvement on present evidence.
- **Harm:** No evidence of adrenal suppression but cannot be excluded with non-standardized delivery and dosage regimes.
- **Cost:** Moderate.
- **Benefits-Harm Assessment:** Off label use, likely negligible side effects compared with oral corticosteroids.
- **Value Judgments:** Only one level 1B study so insufficient data at present.
- **Policy Level:** Option.
- **Intervention:** Nonstandard delivery of topical corticosteroids is an option in CRSwNP, mainly after sinus surgery.

**Oral Corticosteroids:** The data on oral corticosteroids differs considerably depending on whether polyps are present. No published studies exist to determine the benefit of oral corticosteroids alone in CRSsNP, other than one study addressing olfaction. Given the potential risks of systemic corticosteroids, clearer evidence addressing the use of corticosteroids in CRSsNP patients is crucial to balance these risks. There are no current studies evaluating the benefit of oral corticosteroids in the perioperative period, representing a large gap in evidence and a potential area for future study. Due to the lack of clear evidence on the benefits of oral corticosteroids in CRSsNP, no recommendation can be made.

For CRSwNP, the data support the infrequent use of oral corticosteroids. The long-term efficacy of an oral corticosteroid taper, followed by maintenance with INCS is likely 8 to 12 weeks. Practitioners must be aware of the relative benefits vs. risks when developing treatment plans with their patients.

- **Aggregate Grade of Evidence:** A (Level 1b: 5 studies; Level 3: 2 studies; Level 4: 11 studies).
- **Benefit:** Significant short-term improvements in subjective and objective measures in CRSwNP patients. Duration of improvement may last 8 to 12 weeks in conjunction with INCS use.
- **Harm:** More GI symptoms in corticosteroid group, no severe reactions reported. Transient adrenal suppression, insomnia, and increased bone turnover. All established corticosteroid risks exist, particularly with prolonged treatment.
- **Cost:** Low.
- **Benefits-Harm Assessment:** Preponderance of benefit to harm in small, short-term follow-up and with use less than once every 2 years.
- **Value Judgments:** Significant improvements in subjective and objective measures based on high quality data, low risk and low cost. Risks of oral corticosteroids outweigh benefits relative to surgery with use more than once every 2 years.
- **Policy Level:** Recommendation.
- **Intervention:** Oral corticosteroids are recommended in the short-term management of CRSwNP. Longer-term or frequent use of corticosteroids for CRSwNP is not supported by the literature and carries an increased risk of harm to the patient.

**Oral Nonmacrolide Antibiotics for ≤3 Weeks:** The lack of rigorous clinical studies and the combination of AE-CRS and CRS in most studies precludes the ability to make recommendations regarding the use of nonmacrolide antibiotics for less than 3 weeks in CRSsNP. For CRSwNP, despite the widespread use of antibiotics, there is again a paucity of evidence for their efficacy. Antibiotics have a number of potential harms so that their use in CRSwNP in a nonacute exacerbation should be discouraged.

- **Aggregate Grade of Evidence:** B (1 Level 1b study; 1 Level 4 study).
- **Benefit:** Reduction in polyp size with doxycycline; but no change in patient-reported outcomes; lack of placebo in erdosteine trial makes it impossible to determine a benefit for this therapy.
- **Harm:** GI upset and potential for resistance and for anaphylaxis.
- **Cost:** Variable, depending on antibiotic chosen.
- **Benefits-Harm Assessment:** Harm outweighs demonstrated benefits.
- **Value Judgments:** Unclear/limited benefits with significant harm and potentially significant cost.
- **Policy Level:** Recommendation against.
- **Intervention:** Nonmacrolide antibiotics (<3 week course) should not be prescribed for CRSwNP in nonacute clinical situations.

**Oral Nonmacrolide Antibiotics for ≥3 Weeks:** With only 1 study in the literature and only 38% of the patient population showing improvement in the extended treatment duration, recommendation of nonmacrolide oral antibiotics for longer than 3 weeks in treatment of CRSsNP is limited by lack of appropriate evidence.

For CRSwNP, no studies examining the use of nonmacrolide antibiotics for longer than 3 weeks have been published. Therefore, no evidence-based recommendations can be made regarding this practice.

**Oral Macrolide Antibiotics:** A few RCTs concerning macrolides in CRSsNP have been published and 2 have rather compelling findings about the short-term efficacy while 1 shows no benefit. The subgroup of CRSsNP...
patients that best benefit from macrolides is not currently known. Various drugs and dosages have been studied so that the optimal drug and dosages are also not currently known.

- **Aggregate Grade of Evidence:** B (Level 1a: 2 studies; Level 1b: 2 studies; Level 1a-2a: 2 studies; Level 2b: 3 studies).
- **Benefit:** Reduction in endoscopy scores and some symptoms in patients with CRSsNP, particularly in patients without elevated IgE. Effects appear to be comparable to INCS. Benefit may not last long following cessation of therapy.
- **Harm:** Significant potential for medication interactions. Rare mild adverse events, particularly potential for severe cardiovascular complications.
- **Cost:** Low.
- **Benefits-Harm Assessment:** Benefits appear to outweigh harms. Benefit of treatment over placebo is seen in most but not all studies. Harm, though rare, is significant.
- **Value Judgments:** Macrolides appear to confer a benefit in the short term. The benefit may not last following cessation of therapy. Optimal drug, dosage, and length of therapy are not known.
- **Policy Level:** Option.
- **Intervention:** Macrolides are an option for patients with CRSsNP.

For CRSwNP, the picture is similar. Limited data from 1 RCT as well as lower-level evidence demonstrate some benefit, particularly following ESS. Existing studies have utilized different drugs, dosages, and durations of therapy.

- **Aggregate Grade of Evidence:** B (Level 1b: 2 studies; Level 2b: 5 studies; Level 3b: 1 study; Level 4: 1 study).
- **Benefit:** Macrolides appear to reduce polyph burden in post-ESS patients and improve CRS symptoms.
- **Harm:** Significant potential for medication interactions. Rare mild adverse events, particularly potential for severe cardiovascular complications.
- **Cost:** Low.
- **Benefits-Harm Assessment:** Benefits appear to outweigh harm, though data are limited.
- **Value Judgments:** Limited data to determine benefit-harm balance. Optimal drug, dosage, and duration of therapy are not known.
- **Policy Level:** Option.
- **Intervention:** In CRSwNP, macrolides may be beneficial in setting following ESS to decrease recurrence of polyps.

- **Intravenous Antibiotics:** The high preponderance of adverse events noted in the literature in the treatment of CRS with IV antibiotics makes it difficult to recommend. Associated costs of line placement and the treatment of the potential adverse events preclude it from being a cost effective option in the uncomplicated CRS patient. However, for the subset of patients with CRS complications or extrasinus manifestations of CRS, the benefits of treatment may outweigh the cost and risk of possible adverse events.
  - **Aggregate Grade of Evidence:** C (Level 4: 3 studies).
  - **Benefit:** Possible improvement in patient-reported symptoms in cohort and case-controlled studies.
  - **Harm:** Thrombophlebitis, neutropenia, sepsis, deep vein thrombosis, elevated liver enzymes, drug adverse events, rash, bleeding.
  - **Cost:** High.
  - **Benefits-Harm Assessment:** Risk of harm over the possible benefits noted.
  - **Value Judgments:** Risk of adverse events and cost of treatment greatly outweighs possible benefit for routine use in CRS.
  - **Policy Level:** Recommendation against.
  - **Intervention:** Intravenous antibiotics should not be used for routine cases of CRS. For patients with complications or extrasinus manifestations of CRS, the benefits of treatment may outweigh the cost and risk of possible adverse events.

- **Topical Antibiotics:** Existing evidence of topical antibiotics in CRS fails to consistently demonstrate benefits. Their routine use cannot be recommended. Some case series have reported effectiveness, particularly in recalcitrant cases of CRS, suggesting there may be a role in unusual cases.
  - **Aggregate Grade of Evidence:** B (Level 1b: 4 studies; Level 2a: 6 studies; Level 4: 4 studies).
  - **Benefit:** RCTs failed to show any benefit from the use of topical antibiotic irrigations.
  - **Harm:** Nasal congestion, irritation, epistaxis. Theoretical possibility of systemic absorption with topical aminoglycosides. Possibility of developing bacterial resistance.
  - **Cost:** Moderate to high (US$2.64 to US$7.64) per dose, depending on antibiotic and formulation.
  - **Benefits-Harm Assessment:** Relative harm over benefit.
  - **Value Judgments:** Topical therapy may be a preferable alternative to IV therapy for infections caused by organisms resistant to oral antibiotics.
  - **Policy Level:** Recommendation against.
  - **Intervention:** Topical antibiotics are not recommended for CRS.

- **Oral Antifungals:** On the basis of the available literature, there is no evidence to support the use of systemic antifungal treatment in the routine management of CRSsNP or CRSwNP.

- **Topical Antifungals:** For both CRSsNP and CRSwNP, the available evidence demonstrates no benefit with potential harm and cost. The summary for CRSsNP follows:
ICAR Executive Summary

- **Aggregate Grade of Evidence**: A (Level 1a: 1 study; Level 1b: 2 studies).
- **Benefit**: RCTs failed to show any symptomatic benefit from the use of topical antifungal irrigations.
- **Harm**: The irrigations are generally well tolerated.
- **Cost**: Moderate.
- **Benefits-Harm Assessment**: No benefit with rare harm and moderate cost.
- **Value Judgments**: None.
- **Policy Level**: Recommendation against.
- **Intervention**: Topical antifungal agents are not recommended for CRSsNP.

For CRSwNP, the findings are similar:

- **Aggregate Grade of Evidence**: A (Level 1a: 1 study; Level 1b: 4 studies).
- **Benefit**: No demonstrated benefit of topical antifungals in management of typical CRSwNP, but may have some benefit in certain CRSwNP subsets, such as AFRS.
- **Harm**: Main side effect reported is local irritation. Meta-analysis performed in the Cochrane Review did not demonstrate a statistically significant difference in adverse effects between treatment and placebo groups.
- **Cost**: Moderate.
- **Benefits-Harm Assessment**: With no benefit seen for CRSwNP patients generally, the benefits cannot outweigh the risks and costs.
- **Value Judgments**: None.
- **Policy Level**: Recommendation against.
- **Intervention**: Topical antifungal agents should not be used in routine CRSwNP treatment.

- **Surfactants**: One RCT has shown no benefit of baby shampoo over control and patients in the treatment group had higher rate of side effects and study discontinuation. While there appears to be a balance of benefit and harm, because of the limited clinical data, no recommendation is given for the use of surfactants in CRS.

- **Manuka Honey**: The only 2 clinical studies thus far on Manuka honey are small case series in allergic fungal RS. The concentration of the active agent in Manuka honey is variable so that caution should be used in its use. Because of the paucity of evidence, no recommendation for the use of Manuka honey in CRSsNP and CRSwNP is possible.

- **Xylitol**: One small RCT with 25% dropout has shown limited symptom benefit with xylitol. In vitro studies have shown enhancement of innate immunity. Potential harm is limited to minor irritation and cost of therapy is low. Due to the limited amount of evidence, no recommendation regarding xylitol therapy in CRS is possible.

- **Colloidal Silver**: Topical silver use has significant safety concerns and no evidence exists regarding its efficacy in CRSsNP or CRSwNP. Topical silver is not recommended in CRS.

- **Immune Workup and Treatment**: Evaluation of immunodeficiency can uncover a potentially treatable cause of CRS. The effect of immunoglobulin replacement is controversial and this is a challenging issue on which to provide guidelines, because IVIG carries the risk of significant side effects and can be expensive. The long-term benefit of Ig replacement in controlling RS is less encouraging.

- **Aggregate Grade of Evidence**: C (Level 1b: 1 study; Level 2b: 2 studies; Level 3b: 2 studies; Level 4: 1 study; Level 5: 6 studies).
- **Benefit**: Unclear benefit from prophylactic antibiotics and Ig replacement in immunodeficient patients.
- **Harm**: Potential for bacterial resistance with the use of prophylactic antibiotics. Potential for side effects with IVIG.
- **Cost**: Moderate to high, depending on regimen.
- **Benefits-Harm Assessment**: Balance of benefit and harm.
- **Value Judgments**: Most studies involving immune function testing are performed in “recalcitrant” patients who have not responded to typical medical and surgical therapy. This group is poorly defined. Moreover, the level of evidence (LOE) is low.
- **Policy Level**: Option.
- **Intervention**: Treatment of immunodeficiency is an option for “recalcitrant” CRS patients (Table III-6).

- **Antileukotriene Therapy**: Two reviews have demonstrated a limited benefit to antileukotriene therapy in CRSwNP. The risks vary with the specific drug chosen.

- **Aggregate Grade of Evidence**: A (Level 1a: 2 studies).
- **Benefit**: Improvement in symptoms, comparable to INCS. May have limited benefit as an adjunct to INCS.
- **Harm**: Limited risks. Montelukast has been associated with rare neuropsychiatric events in post-marketing reports. Zileuton and other medications are associated with elevated liver enzymes.
- **Cost**: Moderate.
- **Benefits-Harm Assessment**: Balance of benefit and harm.
- **Value Judgments**: Montelukast may be beneficial in patients who are intolerant or unresponsive to INCS.
- **Policy Level**: Option.
- **Intervention**: Montelukast is an option for CRSwNP patients either instead of or in addition to INCS.
III.E. Results - Surgery for Chronic Rhinosinusitis

Endoscopic sinus surgery (ESS) is the standard surgical treatment for CRS that has failed more conservative treatments. Although widely practiced, the timing of surgery and the extent of surgery are 2 issues that generate vigorous discussion, yet little evidence informs this debate. The ICAR:RS document addresses these issues as well as critically examines the evidence in other aspects of ESS, such as middle turbinate preservation and postoperative care.

**Appropriate Medical Therapy (previously “Maximal” Medical Therapy)**

Statements regarding indications for sinus surgery invariably cite “failure of maximal medical therapy” (MMT) as a prerequisite. However, although there is a high level of consistency between guidelines regarding the need for such a trial, there is no consensus on what MMT entails. The ICAR:RS document highlights recent work demonstrating how prolongation of the time between diagnosis and surgery for CRS may negatively impact outcomes. Such findings question the practice of delaying surgery until all available options have been exhausted. Therefore, instead of using the term “maximal medical therapy,” the ICAR:RS document uses the term “appropriate” medical therapy (AMT). AMT is used in order to suggest striking a balance between proceeding to surgery before appropriate nonsurgical options have been tried and delaying too long so that outcomes are negatively impacted. ICAR:RS then attempts to provide an evidence-based definition of AMT in both CRSsNP and CRSwNP.

- **Aspirin Desensitization:** A significant amount of clinical evidence supports the use of aspirin desensitization in patients with aspirin-exacerbated respiratory disease (AERD). Heterogeneity of dosing regimens clouds the picture somewhat. More recently elaborated evidence with low-dose desensitization has demonstrated efficacy and it should be recommended in patients with uncontrolled AERD.
  - **Aggregate Grade of Evidence:** B (Level 1b: 4 studies; Level 2a: 3 studies; Level 2b: 6 studies; Level 2c: 2 studies; Level 3b: 1 study; Level 5: 1 study).
  - **Benefit:** Reduced polyp re-formation after surgery, increased QoL and reduced CRS-symptoms in AERD. Reduced need for systemic corticosteroids. Reduced number of surgical revisions.
  - **Harm:** Gastrointestinal bleeding, increased morbidity in renal disease and blood clotting issues at high maintenance doses. Less than 3% gastrointestinal side effects with low-dose protocols.
  - **Cost:** (1) Initial cost of desensitization. (2) Minimal direct costs for 100 mg aspirin daily. (3) Potentially costs reduced if future surgical interventions reduced, less medication use, fewer physician visits for asthma.
  - **Benefits-Harm Assessment:** Clear benefit over harm.
  - **Value Judgments:** Aspirin desensitization is 1 of the very few causative medical treatment options available in patients with CRSwNP.
  - **Policy Level:** Recommendation.
  - **Intervention:** Aspirin desensitization should be considered in AERD patients after surgical removal of NPs to prevent recurrence.

**Definition of Appropriate Medical Therapy Prior to ESS:** The evidence for what should constitute appropriate medical therapy prior to surgical intervention is very much lacking. Recommendations are given based on available evidence, but the grade of evidence is D, leading to weak strength of recommendation.

- **Aggregate Grade of Evidence:** D.
- **Benefit:** Symptomatic improvement and avoidance of risks of surgical intervention.
- **Harm:** Risks of corticosteroids, gastrointestinal side effects of antimicrobials, risk of cardiovascular toxicity with macrolide antibiotics, potential for increasing antibiotic resistance.
- **Cost:** Direct cost of medications.
- **Benefits-Harm Assessment:** Differ for particular therapy and clinical scenario.
- **Value Judgments:** Perceived lower risk of antibiotic treatment vs. risks of surgery, although recent evidence has shown a low breakeven threshold for surgery vs. oral corticosteroids. Additional evidence is needed in assessing antibiotic vs surgery benefit-harm balance. Clearly, patient preference plays a large role in the decision to continue medical therapy or to proceed with surgery.

**Policy level:** Recommendation.

**Intervention:**

- **For CRSwNP:** Appropriate medical therapy prior to surgical intervention should include a trial of INCS, saline irrigations, and a single short course of oral corticosteroids. Antibiotics are an option.
- **For CRSsNP:** Appropriate medical therapy prior to surgical intervention should include INCS, saline irrigations, and antibiotics. Oral corticosteroids are an option.
- **Length of Appropriate Medical Therapy Prior to ESS:** There are no direct studies on this topic and recommendations are inferred from studies on individual therapies. There are multiple RCTs evaluating the benefits of INCS in CRS. Studies where treatment duration is less than or equal to 3 weeks show no benefit over placebo, whereas studies of 4 weeks or more consistently favor INCS.
TABLE III-6. Recommendations for treatment of immune deficiency in “recalcitrant” CRS patients

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Grade of evidence</th>
<th>Balance of benefit to harm</th>
<th>Recommendation</th>
<th>Protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other immune therapy</td>
<td>A</td>
<td>Equal</td>
<td>Recommendation against</td>
<td>Thymic hormone preparation thymostimulin</td>
</tr>
<tr>
<td>Immunoglobulin replacement</td>
<td>B</td>
<td>Equal</td>
<td>Optional</td>
<td>Common variable immunodeficiency</td>
</tr>
<tr>
<td>Prophylactic antibiotics</td>
<td>C</td>
<td>Equal</td>
<td>Optional</td>
<td></td>
</tr>
<tr>
<td>ESS</td>
<td>C</td>
<td>Equal</td>
<td>Optional</td>
<td></td>
</tr>
<tr>
<td>Early culture-directed antibiotics</td>
<td>D</td>
<td>Equal</td>
<td>Optional</td>
<td></td>
</tr>
</tbody>
</table>

CRS = chronic rhinosinusitis; ESS = endoscopic sinus surgery.

- Aggregate Grade of Evidence: D.
- Benefit: Symptomatic improvement and avoidance of risks of surgical intervention.
- Harm: Risks of corticosteroids, gastrointestinal side effects of antimicrobials, risk of cardiovascular toxicity with macrolide antibiotics, potential of increasing antibiotic resistance.
- Cost: Direct cost of medications.
- Value Judgements: Low risk of treatment and delay of surgery vs risks of surgery considered in recommending a 3-week to 4-week trial.
- Policy Level: Recommendation
- Intervention: A trial of 3 to 4 weeks of AMT should be considered as the minimum.

**Preoperative Management**

Once the decision is made to pursue ESS for a patient, what medical therapy is appropriate prior to surgery in order to maximize the safety and efficacy of the surgical procedure? Evidence-based recommendations regarding common treatments are made.

- **Topical Steroids**
  - Aggregate Grade of Evidence: C (Level 1b: 1 study; Level 5: 1 study).
  - Benefit: Objective improvement in surgical field, objective decrease in intraoperative bleeding, and objective decrease in operation time seen with INCS. Subjective improvement in surgical difficulty.
  - Harm: Possible side effects of topical are known.
  - Cost: Low.
  - Benefit-Harm Assessment: Preponderance of benefit over harm in INCS.
  - Value Judgment: Improvement in surgical field is important. There is no evidence-based agreement on dosage and duration. In case of oral corticosteroids, medium dose (30 to 40 mg) for 4 to 7 days is the most commonly prescribed regimen. Other techniques (eg, use of concentrated epinephrine) may be used to diminish bleeding intraoperatively.
  - Policy Level: Recommendation for CRSwNP. No recommendation for CRSsNP.
  - Intervention: Recommendation for the use of oral corticosteroids in the preoperative management of CRSwNP.

- **Antibiotics**: Because of a paucity of evidence, no recommendation regarding preoperative antibiotics can be made.

- **Oral Corticosteroids**
  - Aggregate Grade of Evidence: B (Level 1b: 2 studies; Level 2b: 2 studies; Level 4: 1 study; Level 5: 1 study); one study shows contradicting results.
  - Benefit: Objective improvement in surgical field, decrease in intraoperative bleeding, and decrease in operation time. Subjective improvement in surgical difficulty.
  - Harm: No specific reports about side effect as preoperative treatment, but possible risks of corticosteroids are known.
  - Cost: Low.
  - Benefit-Harm Assessment: Preponderance of benefit over harm in CRSwNP. Balance is unknown in CRSsNP.
  - Value Judgment: Improvement in surgical field is important. There is no evidence-based agreement on dosage and duration. In case of oral corticosteroids, medium dose (30 to 40 mg) for 4 to 7 days is the most commonly prescribed regimen. Other techniques (eg, use of concentrated epinephrine) may be used to diminish bleeding intraoperatively.
  - Policy Level: Recommendation for CRSwNP. No recommendation for CRSsNP.
  - Intervention: Recommendation for the use of oral corticosteroids in the preoperative management of CRSwNP.

**Surgical Techniques**

Evidence-based recommendations for the surgical management of chronic rhinosinusitis are summarized in Table III-7.

- **Extent of Surgery**: The extent of endoscopic procedures ranges from balloon dilation through standard ESS techniques to extensive procedures like nasalization. The current evidence does not clarify whether minimal or
TABLE III-7. Summary of recommendations for ESS

<table>
<thead>
<tr>
<th>Intervention</th>
<th>LOE</th>
<th>Benefit</th>
<th>Harm</th>
<th>Cost</th>
<th>Benefit-harm assessment</th>
<th>Policy level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extent of surgery</td>
<td>C</td>
<td>Reduced manipulation of tissue has the potential for less scarring</td>
<td>Potential for insufficient removal of obstructing and inflamed tissue with minimal techniques</td>
<td>High costs associated with OR time and devices</td>
<td>Unknown</td>
<td>Option for less extensive interventions</td>
</tr>
<tr>
<td>Concurrent septoplasty</td>
<td>D</td>
<td>Reduction in nasal obstruction, improved access for ESS</td>
<td>Pain, septal hematoma and perforation, intranasal scarring</td>
<td>High, related to increased OR time</td>
<td>Benefit outweighs harm</td>
<td>Option for patients with nasal septal deviation</td>
</tr>
<tr>
<td>Middle turbinate preservation vs resection</td>
<td>C</td>
<td>Resection may lengthen time to polyp recurrence</td>
<td>Loss of landmark for revision surgery</td>
<td>No additional costs</td>
<td>Not fully known, but likely balance of benefit and harm</td>
<td>Option</td>
</tr>
<tr>
<td>Image guidance</td>
<td>D</td>
<td>Potential for reduced complications</td>
<td>None</td>
<td>Moderate</td>
<td>Benefits outweigh risks</td>
<td>Option</td>
</tr>
<tr>
<td>Packing</td>
<td>A</td>
<td>Multiple studies demonstrate packing is not necessary; may provide hemostasis in some cases; potential reduction of adhesions</td>
<td>Increased discomfort and some materials may increase risk of adhesions</td>
<td>Variable, depending on material chosen</td>
<td>Balance of risks and benefits</td>
<td>Option</td>
</tr>
<tr>
<td>Drug eluting packing, stents, and spacers</td>
<td>A</td>
<td>Reduction in polyp and adhesion formation</td>
<td>Potential for misplacement and local reaction</td>
<td>Variable, depending on material chosen</td>
<td>Preponderance of benefit over harm</td>
<td>Consensus could not be reached on a recommendation</td>
</tr>
</tbody>
</table>

ESS = endoscopic sinus surgery; OR = operating room.

maximal techniques are best for a particular patient population.

- **Aggregate Grade of Evidence:** C (Level 1b, 3 studies; Level 2b, 3 studies; Level 5, 1 study).
- **Benefit:** Although no studies have demonstrated a direct benefit of more conservative (less extensive) surgical approaches for treatment of CRS compared to traditional ESS, reduced manipulation of sinonasal tissues with these limited approaches, including minimally invasive sinus technique (MIST) or balloon dilation, has the potential to reduced postoperative scar formation and surgical time.
- **Harm:** Potential harm of more conservative techniques includes insufficient removal of obstructing sinonasal disease, leading to faster relapse of symptoms and reduced delivery of topical medications.
- **Cost:** Although no studies have examined the issue of cost related to modified ESS techniques, shorter operative time could translate to lower costs in some circumstances. In contrast, balloon-dilation technology is associated with increased equipment costs per case which needs to be considered in an environment of limited healthcare resources.
- **Benefits-Harm Assessment:** Over the short-term (up to 1 year postoperatively), conservative approaches do not appear to increase harm from recurrence of inflammatory sinus disease, particularly in patients with limited sinus disease.
- **Value Judgments:** Conservative approaches (MIST or balloon dilation) appear to provide short-term clinical outcomes that are comparable to traditional ESS in patients with limited disease. For patients with moderate-to-severe CRS, traditional ESS has the potential for improved long-term sinus ventilation and delivery of topical medications. There is no significant argument for or against the use of less extensive sinus procedures. All studies to date have suggested equivalent short-term outcomes as compared to traditional large-hole technique in patients with minimal sinus disease.
- **Policy Level:** Option.
- **Intervention:** Less extensive sinus interventions are likely reasonable options in patients with minimal ostiomeatal complex or maxillary sinus disease.

- **Concurrent Septoplasty:** With the impact of septal deviation on CRS pathogenesis either minimal or nonexistent, it is not surprising that the role of septoplasty in addressing CRS is unclear as well.

- **Aggregate Level of Evidence:** D (Level 2a, 1 study; Level 4, 8 studies; Level 5, 1 study).
- **Benefit:** Reduction in nasal obstruction, improved access for ESS.
\textbullet \textbf{Middle Turbinate Preservation vs Resection}: Rigid adherence to middle turbinate (MT) preservation or routine MT resection is not supported by the cumulative evidence. Low level evidence supports both positions. As a result, management of the MT requires a thoughtful approach with considerations of all potential risks, benefits, and alternatives.

- Aggregate Grade of Evidence: C (Level 1b: 2 studies; Level 2b: 6 studies; Level 3b: 1 study; Level 4: 11 studies).
- Benefit: Lengthening of time to recurrence of NPs, possible improvement in olfaction, improved endoscopy scores.
- Harm: Loss of landmark for revision surgery, leading to increased risk of intraoperative complications.
- Cost: No additional cost beyond those associated with ESS.
- Benefits-Harm Assessment: Most of the potential risks and benefits postulated for MT resection are not supported in the literature.
- Value Judgments: MT resection may improve access to the ethmoid cavity during ESS. Thoughtful consideration must be given alternatives to removing a non diseased structure to improve access. The vast majority of the literature purported to support both MT resection and MT preservation is low level and most shows no effect.
- Policy Level: Option.
- Intervention: MT resection may be employed during ESS, especially in cases of CRSwNP.

\textbullet \textbf{Image Guidance}: The use of image guidance in ESS appears common yet has little supportive evidence. One recent meta-analysis has demonstrated efficacy, whereas the remaining literature on this topic is low level.

- Aggregate Grade of Evidence: D (Level 2a: 1 study; Level 3b: 6 studies; Level 4: 33 studies; Table X-11 in ICAR:RS).
- Benefit: Potential for reduction of complications and more complete surgery.
- Harm: None identified.
- Cost: Moderate. Cost is due to additional equipment, time for setup.
- Benefits-Harm Assessment: Benefits outweigh risks, potentially outweigh costs.
- Value Judgments: Benefit is likely achieved in more difficult cases, with a higher risk of complication. Achievement of high levels of evidence are complicated by the need for very large sample sizes and possible ethical issues involving clinical equipoise.
- Policy Level: Option.
- Intervention: Image guidance is an option for ESS for CRSsNP and CRSwNP.

\textbullet \textbf{Use of Packing}: Multiple studies support the position that packing is not necessary for hemostasis in the vast majority of ESS cases. However, in some cases it is necessary and existing evidence supports its hemostatic capabilities as well as addresses wound healing and patient comfort.

- Aggregate Grade of Evidence:
  - Intraoperative Hemostasis: A (Level 1b: 5 studies; Level 3b: 1 study; Level 4: 2 studies).
  - Postoperative Hemostasis: A (Level 1b: 11 studies; Level 3b: 1 study; Level 4: 1 study).
  - Wound Healing: A (Level 1b: 21 studies; Level 3b: 1 study).
  - Patient Comfort: A (Level 1b: 13 studies).
- Harm: Potential for increased discomfort while in situ and on removal. Rare risk of toxic shock syndrome. Potential for an increased rate of clinically significant adhesions with some materials.
- Cost: There is a cost associated with all packing materials, with absorbable materials being more costly than nonabsorbable packing.
- Benefits-Harm Assessment: Balance of risks and benefits.
- Value Judgments: For the majority of sinus surgical cases packing is not required for intraoperative hemostasis and will not reduce the risk of postoperative epistaxis. Although evidence does exist suggesting packing may reduce adhesion formation, it
### TABLE III-8. Evidence-based recommendations for postoperative care following endoscopic sinus surgery

<table>
<thead>
<tr>
<th>Intervention</th>
<th>LOE</th>
<th>Benefit</th>
<th>Harm</th>
<th>Cost</th>
<th>Benefit-harm assessment</th>
<th>Policy level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saline irrigations</td>
<td>B</td>
<td>Well-tolerated. Improved symptoms and endoscopic appearance</td>
<td>Local irritation, ear symptoms</td>
<td>Minimal</td>
<td>Preponderance of benefit over harm</td>
<td>Recommendation for use of nasal saline irrigation</td>
</tr>
<tr>
<td>Sinus cavity debridements</td>
<td>B</td>
<td>Improved symptoms and endoscopic appearance, reduced risk of synechia and turbinate lateralization</td>
<td>Inconvenience, pain, epistaxis, syncope, and mucosal injury</td>
<td>In-office procedure with cost</td>
<td>Preponderance of benefit over harm</td>
<td>Recommendation for postoperative debridement</td>
</tr>
<tr>
<td>Topical corticosteroids</td>
<td>A</td>
<td>Improved symptoms and endoscopic appearance, reduced recurrence rate of polyps</td>
<td>Epistaxis, headache</td>
<td>Moderate</td>
<td>Preponderance of benefit over harm</td>
<td>Recommendation for standard INCS</td>
</tr>
<tr>
<td>Oral antibiotics</td>
<td>B</td>
<td>Improved symptoms and endoscopic appearance, reduced crusting</td>
<td>GI upset, colitis, anaphylaxis, bacterial resistance</td>
<td>Moderate to high</td>
<td>Balance of benefit and harm</td>
<td>Option for oral antibiotics</td>
</tr>
<tr>
<td>Topical decongestants</td>
<td>N/A</td>
<td>Potential reduced mucosal swelling and bleeding</td>
<td>Increased pain, possible rhinitis medicamentosa</td>
<td>Minimal</td>
<td>Preponderance of harm over benefit</td>
<td>Recommendation against topical decongestants</td>
</tr>
<tr>
<td>Packing/spacers without medication</td>
<td>B</td>
<td>Improved symptoms and endoscopic appearance, reduced risk of synechia and turbinate lateralization</td>
<td>Pain, inconvenience, potential for creating synechia or granulation</td>
<td>Moderate to high, depending on material</td>
<td>Balance of benefit and harm; potential small benefit of absorbable vs. nonabsorbable packing</td>
<td>Option for packing or spacer</td>
</tr>
<tr>
<td>Drug-eluting spacers/stents</td>
<td>A</td>
<td>Reduction in inflammation, polyps, adhesions</td>
<td>Possible systemic absorption, pain, inconvenience</td>
<td>Moderate to high, depending on material and medication</td>
<td>Balance of benefit and cost</td>
<td>Consensus regarding recommendation cannot be reached at this point</td>
</tr>
<tr>
<td>Systemic corticosteroids</td>
<td>N/A</td>
<td>Improvement in endoscopic appearance, reduction in polyp recurrence</td>
<td>Insomnia, mood changes, hyperglycemia, gastritis, increased intraocular pressure, avascular necrosis</td>
<td>Minimal</td>
<td>Balance of benefit and harm</td>
<td>Option for systemic corticosteroids</td>
</tr>
<tr>
<td>Mitomycin C</td>
<td>B</td>
<td>Reduction in synechia formation, improvement in maxillary ostium patency</td>
<td>Off-label use, systemic absorption, local toxicity</td>
<td>Moderate to high</td>
<td>Balance of benefit and harm</td>
<td>Recommendation against mitomycin C</td>
</tr>
</tbody>
</table>

GI = gastrointestinal; INCS = intranasal corticosteroid; LOE = level of evidence; N/A = not applicable.

is limited and has not been compared to studies employing early and frequent debridement.
- **Policy Level:** Option.
- **Intervention:** When bleeding cannot be controlled, packing may help achieve hemostasis, without significant adverse effects on postoperative wound healing.

- **Drug-Eluting Packing, Stents, and Spacers:** Corticosteroid eluting materials appear to have promise in the postoperative period. Additional indications are on the horizon. Clinical experience with this device is relatively narrow at this point and evidence, though at a high level, is limited to short-term outcomes.
  - **Aggregate Grade of Evidence:** A (Level 1b: 2 studies; Level 2b: 1 study).
  - **Benefit:** Reduction in polyposis and adhesions formation, which translates to a reduction in postoperative interventions.
  - **Harm:** Potential for misplacement and local reaction.
Cost: Variable depending on stents and medication. The Propel™ system is estimated at US$700 per implant.

Benefits-Harm Assessment: Preponderance of benefit over harm.

Value Judgments: Corticosteroid-eluting stents have been demonstrated to have beneficial impact on postoperative healing and 1 study has shown them to be cost-effective in preventing additional postoperative interventions. Experience is early and the amount of evidence is small, though high level. Specific usage should be at the clinician’s discretion taking into consideration various important patient-specific factors.

Policy Level: The authors could not come to a consensus on the subject of corticosteroid-eluting stents. They were divided between recommendation (due to the high LOE) and option (due to the limited amount of evidence and experience, as well as cost considerations).

Intervention: Corticosteroid-eluting stents can be considered for placement in the ethmoidectomy cavity.

Postoperative Management
Following ESS, multiple therapies can be employed to maximize the patient’s outcome. These were each reviewed and the findings summarized in Table III-8.

IV. Discussion
This executive summary reviews some of the more important findings of the ICAR:RS. Clearly much is known about RS, and equally as clear is we have much to learn.

ICAR:RS demonstrates the significant impact of evidence-based decision-making in RS. One example is the apparently discordant recommendation of withholding antibiotics in acute bacterial RS. Another example is the clear advantage of treating CRS as an inflammatory, not an infectious disease. The evidence that has significantly increased our understanding of the burden of CRS also informs our decision-making in public policy and research.

One of the most important of the ICAR:RS findings is the rather low level of evidence on which we base many of our management decisions, especially in CRS. Perhaps the number and variety of possible pathophysiologic factors, also prominently addressed in ICAR:RS, are largely to blame for the evidence gap. Many studies in the past have addressed CRS as 1 disease, when it appears this condition is instead made up of a number of manifestations of chronic sinonasal inflammation, likely with separate and overlapping etiologies. Ongoing and future research will better delineate these subtypes of CRS, beyond CRSwNP and CRSsNP, which will lead to more targeted and hopefully more efficacious therapies.

It is our hope that ICAR:RS will sufficiently detail the current gaps in our knowledge and inspire future research efforts.

V. References