Rhinosinusitis

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KEYWORDS

• Rhinosinusitis • Sinus infection • Chronic sinusitis • Acute rhinosinusitis
• Allergic rhinitis • Sinusitis

KEY POINTS

- Sinusitis can typically be diagnosed by history alone, but care must be taken to avoid misdiagnosis when other symptoms are present (allergic, dizziness, isolated ear or facial pain).
- Differentiating acute and chronic rhinosinusitis based on symptoms and duration is a key to guiding next steps in work up and management.
- Distinguishing viral versus bacterial acute rhinosinusitis on clinical presentation is crucial for antibiotic stewardship. Watchful waiting in an evidence-based approach if patient follow-up is possible.
- Medical management is first-line treatment for rhinosinusitis. Intranasal corticosteroids and nasal saline rinses are primary medical therapies with excellent safety and side effects profile.
- Referral to otolaryngology is necessary for persistent or complicated cases.

Video content accompanies this article at http://www.medical.theclinics.com.

INTRODUCTION

Rhinosinusitis—interchangeable with the term sinusitis—is defined as inflammation in the mucosa of the nasal cavity and paranasal sinuses. Rhinosinusitis is highly prevalent and carries significant financial burden, affecting 1 in 8 people in the United States. In 2018 alone, rhinosinusitis accounted for 7.3 million ambulatory physician office visits and 560,000 emergency room visits.[1,2] The annual economic impact of acute and chronic sinusitis is estimated to exceed $18 billion.[3,4] Sinonasal pathology, including sinusitis, is also among the leading reasons for inpatient otolaryngology consultations.[5,6]

This article outlines the distinctions between isolated rhinitis, acute infectious rhinosinusitis (viral vs bacterial), and chronic rhinosinusitis (CRS). It emphasizes key differences in clinical presentations, first-line treatment options, the role of procedures and

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Abbreviations	
AR	allergic rhinitis
ARS	acute rhinosinusitis
ABRS	acute bacterial rhinosinusitis
CRS	chronic rhinosinusitis
CRSwNP	CRS with nasal polyps
CSF	cerebrospinal fluid
CT	computed tomography
FESS	functional endoscopic sinus surgery
IgE	immunoglobulin E
INAH	intranasal antihistamine
INCS	intranasal corticosteroids
NAR	nonallergic rhinitis
TMJ	temporomandibular joint
VMR	vasomotor rhinitis

imaging in diagnosis, and indications for specialist referral. Fungal sinusitis will be discussed in the article Fungal Sinusitis—Invasive vs. Noninvasive by Dr Franzese.

The hallmark symptoms of rhinosinusitis include purulent nasal drainage (anterior, posterior, or both), nasal congestion or obstruction, and facial pain, pressure, or fullness. Additional symptoms include headache, smell loss (hyposmia or anosmia), ear fullness or pressure, and maxillary dental pain.

The presence of facial pain, pressure, or fullness without frequent other sinonasal symptoms is unlikely to be sinonasal in origin and should prompt consideration of other etiologies such as primary headache, dental pathology, and musculoskeletal causes like temporomandibular joint (TMJ) pain.

Rhinosinusitis may be classified further by duration into acute (less than 4 weeks), subacute (4–12 weeks), and chronic (more than 12 weeks). Most clinical practice guidelines in North America and Europe align on the definition of ARS and CRS, while international consensus on subacute rhinosinusitis has not been clearly established.

While a patient's history may indicate likely sinonasal pathology, objective findings of sinonasal inflammation are necessary for confirmation of the diagnosis. Anterior rhinoscopy with a nasal speculum or otoscope can help visualize mucosal edema, purulent drainage, and structural abnormalities, such as inferior turbinate hypertrophy, nasal polyps, or a deviated septum. The oropharyngeal examination should include inspection of the posterior pharyngeal wall for drainage from the nasopharynx above as well as evaluation for dental pathology that may indicate an odontogenic source of sinusitis.

Patients with facial pain or pressure may endorse subjective facial swelling. Objective swelling that is clear to the clinician is rare and should prompt evaluation for more severe complications of sinusitis. The sensitivity of percussion of the frontal and maxillary sinuses for tenderness is limited and is not routinely performed by otolaryngologists. Assessing for proptosis, restricted extraocular movement, or visual disturbances can identify complications such as orbital cellulitis or abscess formation. In rare cases where intracranial extension is a concern, a neurologic examination focusing on cranial nerve function and signs of meningismus should be performed.

Certain patient populations require special consideration, including those with atopic diseases (eg, asthma and environmental allergies), congenital diseases (eg, cystic fibrosis and primary ciliary dyskinesia), and risk factors for immunodeficiency (eg, human immunodeficiency virus [HIV], uncontrolled diabetes, heart failure, or immunomodulating/immunosuppressing medications).

By integrating data from a detailed history and a through physical examination, physicians can better diagnose and classify rhinosinusitis, initiate appropriate first-line

management, and recognize when specialist referral is warranted. In patients that do not meet diagnostic criteria, management of other etiologies like primary headache, dental pathology, or TMJ pain can be initiated.

DISCUSSION

Acute Rhinosinusitis

Clinical presentation

Acute rhinosinusitis (ARS) is defined as up to 4 weeks of purulent nasal drainage (anterior, posterior, or both) accompanied by nasal congestion/obstruction, facial pain/pressure/fullness, or both.[7] Purulent (discolored, nonclear) nasal drainage must be present for the diagnosis of ARS, as nasal obstruction alone may be caused by anatomic structural issues, and facial pain or pressure alone could be presenting symptoms of headache.[8] Patients often report preceding or concurrent upper respiratory symptoms such as cough, sore throat, hoarseness, ear fullness, and nonspecific symptoms such as fever, headache, and malaise.

Distinguishing between viral and bacterial ARS is essential, as viral sinusitis does not require treatment with antibiotics. While purulent drainage is often associated with bacterial etiology, purulence alone is insufficient to make the distinction. Instead, duration and illness pattern are key.[9] Acute viral rhinosinusitis is defined as ARS lasting less than 10 days without worsening symptoms. Acute bacterial rhinosinusitis (ABRS) is diagnosed when symptoms of ARS persist beyond 10 days without improvement, or worsen after an initial period of recovery (ie, double worsening).[7]

Other diagnostic testing

Culture. Routine nasal or nasopharyngeal swabs for culture are not recommended. Even with needle aspiration within the maxillary sinus or endoscopically directed middle meatal cultures (the preferred of the 2), bacterial pathogens are only identified in about half of patients with ARS and correlate poorly to imaging or examination findings.[10,11] Cultures should be reserved for cases involving immunocompromised patients, refractory disease, or complications. In such cases, otolaryngologist may be consulted to obtain endoscopically directed middle meatal cultures to target therapy.[12]

Imaging. Routine computed tomography (CT) imaging is not indicated in diagnosing uncomplicated ARS.[13] Studies show no correlation between sinus symptoms and radiologic findings.[14] Imaging should be reserved for:

- Prolonged symptoms refractory to empiric antibiotic treatment
- Signs of complicated ARS
- Suspicion of alternative diagnosis (eg, malignancy and trauma).

If complicated ARS is suspected, contrast-enhanced CT or MRI is preferred.[13]

Laboratory Studies. Elevated white blood cell count (WBC), C-reactive protein, and/or erythrocyte sedimentation rate have been correlated with ABRS and may support a diagnosis of ABRS.[15] However, these tests are neither sensitive nor specific, and thus should not be used as a screening or diagnostic test.[16]

Management and treatment

Rhinosinusitis was the diagnosis most frequently associated with antibiotic prescriptions in 2010 to 2011.[17] Over 80% of sinusitis encounters resulted in antibiotics prescriptions and 30% were prescribed outside of clinical practice guideline recommendations.

Given that primary care providers and hospitalists see ARS patients at a 22:1 ratio compared with otolaryngologist, their role in antibiotic stewardship is critical.[10,18]

Management of both viral and bacterial acute rhinosinusitis begins with supportive care:[19,20]

- Analgesics/antipyretic drugs for pain and fever
- Nasal saline irrigation for symptom relief
- Intranasal corticosteroids (INCS)
- Oral/nasal decongestants, expectorants, and cough suppressants may be considered

The use of intranasal decongestant may be considered to augment therapeutic response to INCS but its use should be limited to a maximum of 3 to 4 days to prevent rhinitis medicamentosa. Systemic steroids may be considered as an adjunct to oral antibiotics for treatment of ABRS.[21] The risks of oral steroids should not be underestimated, and frequent or prolonged courses should be avoided.

For patients who fit a clinical diagnosis of ABRS, watchful waiting is an evidence-based first approach when close follow-up is possible. Multiple systematic reviews indicate that most ABRS resolved spontaneously at similar rates between days 7 to 15, with antibiotics only slightly accelerating symptom relief.[22–24]

When severe symptoms persist beyond 10 days and antibiotic therapy is warranted, the first-line antibiotic of choice is amoxicillin with clavulanate for 5 to 10 days. In those with penicillin allergies, either doxycycline or a respiratory fluoroquinolone should be used instead. Macrolides such as azithromycin, the most prescribed antibiotics in a nonotolaryngology office setting,[10,18] are no longer recommended for the treatment of ABRS due to high rates of resistance among *Streptococcus pneumoniae*.[12] Empiric coverage for MRSA is not recommended.

Complications of acute rhinosinusitis

Complicated ARS refers to the spread of infection beyond the paranasal sinuses. Complications are categorized as orbital, local, or intracranial. While these complications are rare, they should be understood by the hospitalist as they often prompt emergent evaluation and inpatient care.

Orbital complications are the most common and are categorized by the Chandler classification. This system describes a progression from groups I to V: preseptal cellulitis, orbital cellulitis, subperiosteal abscess, orbital abscess, and cavernous sinus thrombosis, respectively.[25] Local extension beyond the sinuses can lead to facial cellulitis, abscess formation, or osteomyelitis—such as Pott's puffy tumor, a misnamed but serious complication characterized by frontal bone osteomyelitis. Intracranial complications include meningitis, empyema, brain abscess, cavernous sinus thrombosis, and/or dural sinus thrombosis.

On physical examination, red flags findings include severe headache, vision changes, proptosis, cranial nerve palsies, and obvious facial swelling with overlying skin changes. The presence of any of these symptoms warrant urgent evaluation, including contrast enhanced imaging (CT and/or MRI), and further management.

Broad spectrum intravenous antibiotics should be started immediately. Surgical specialists (ie, otolaryngologist, ophthalmologist, and neurosurgery) should be consulted promptly. When medical management fails, surgical management of complicated ARS usually involves functional endoscopic sinus surgery (FESS) but may also require ophthalmologic and/or neurosurgical intervention.

Chronic Rhinosinusitis

Clinical presentation

CRS is defined as the presence of 2 or more of the following for at least 12 consecutive weeks: nasal obstruction, purulent nasal drainage, facial pain/pressure, or hyposmia/anosmia and objective evidence of inflammation. This can be on physical examination (eg, purulent mucus in the middle meatus, nasal polyps, or mucosal edema on nasal endoscopy) or via radiographic imaging (evidence of inflammation in the paranasal sinuses).

CRS may be further described by phenotypes or endotypes. Common phenotypes include CRS without nasal polyps, CRS with nasal polyps (CRSwNP), and allergic fungal rhinosinusitis. Endotypes refers to the underlying pathophysiology of the disease and are broadly categorized into Th2-mediated versus non-Th2-mediated inflammatory pathways. The details of these subtypes are beyond the scope of this article, but current research in CRS aims to develop targeted therapy for specific endotypes.

Radiographic findings

Noncontrast CT of the maxillofacial region is the imaging modality of choice for evaluating CRS. Typical findings in CRS include mucosal thickening, sinus opacification, and bone remodeling (**Fig. 1**A–C).

MRI can further assess soft tissue structures and differentiate between neoplasms, polyps, fungus ball, and postobstructive inspissated secretions. However, MRI is usually only obtained in special cases.

The prevalence of incidental sinus abnormalities in patients who underwent head CT or MRI for nonsinus-related indications is as high as 40% for CT and 85% for MRI, as CTs of the head and MRIs of the brain will frequently capture a portion or all of the sinuses.[26] Incidental findings such as mucus retention cysts or scant mucosal thickening at the base of the maxillary sinuses due to dental disease are often asymptomatic (**Fig. 2**A, B). It is crucial to correlate these incidental findings with patient symptoms prior to obtaining further diagnostic tests, initiating treatment, and consulting specialists.

Review of CT imaging by non-otolaryngologists is helpful in differentiating minor incidental findings from true pathology. It can help narrow the differential in patients with symptoms that may fit rhinosinusitis but may also be from other etiologies. The sinuses are best visualized on coronal views. Sinuses that are functioning well and are normal will be aerated and thus will appear black (Video 1). Significant opacification typically indicates pathology while normal appearing sinuses rules out CRS.

Management and treatment

Medical management. First-line treatment for CRS includes nasal saline irrigations and daily INCS.[7,27] INCS may take multiple days for full therapeutic effect, and

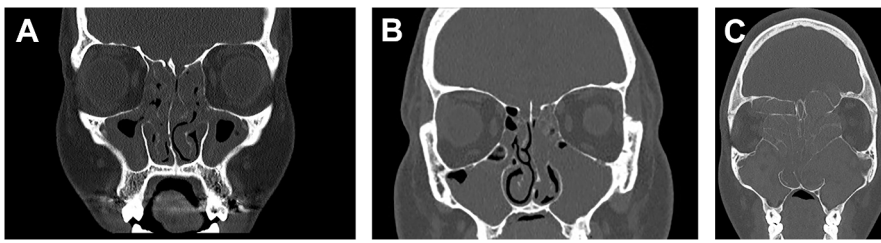


Fig. 1. (*A–C*) Characteristic CT findings in CRS. (*A*) Mucosal thickening. (*B*) Sinus opacification. (*C*) Bony remodeling.

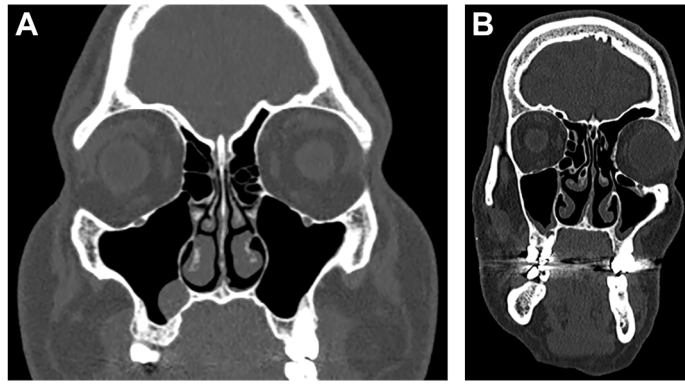


Fig. 2. (*A*) Mucus retention cyst in right maxillary sinus (*B*) Scant mucosal thickening at the base of the bilateral maxillary sinuses due to dental disease.

prolonged patient adherence is critical for evaluating response to treatment. A short course of systemic corticosteroids may also be useful for acute exacerbations of CRS in patients with CRSwNP.[28]

Although CRS is primarily an inflammatory response, bacterial superinfection can occur. If purulent nasal drainage is present, a course of antibiotics such as amoxicillin-clavulanate or doxycycline may be indicated.[29]

Patients who fail standard medical therapy should be referred to otolaryngology for further evaluation. Biologic therapies targeting type 2 cytokines have demonstrated efficacy in CRSwNP and are predominantly used to treat recurrent disease after standard medical and surgical therapy.[30–32] These therapies are also approved for use in asthma and may provide dual benefit in patients with comorbid asthma and CRSwNP.

Other adjunct therapies for CRS, tailored to CRS subtype, include steroid sinonasal irrigations, aspirin desensitization (in aspirin exacerbated respiratory disease), and antihistamines for patients with concurrent allergic disease.

Surgical intervention. Surgical intervention is indicated when patients fail maximal medical therapy. Many insurance providers require documentation of at least 4 to 12 weeks of treatment with INCS with persistent symptoms before approving surgery.

FESS is the standard surgical intervention for CRS. The goal of surgery is to widen the sinus outflow tracts to improve drainage and enhance delivery of topical medications (eg, steroid sinonasal irrigations). Preoperative evaluation includes a maxillofacial CT scan with thin cuts, sometimes referred to as “Stealth protocol,” named for a surgical navigation system frequently used in the operating room during FESS.

FESS is typically an outpatient procedure and lasts approximately 1.5 hours per side. Preoperative assessment determines whether adjunctive procedures, such as septoplasty, may be needed for surgical access and can be beneficial for optimizing surgical outcomes in patients with significant septal deviation.

Postoperative complications. The most common postoperative complications are bleeding and acute sinusitis. For postoperative epistaxis, compression of the soft nasal vestibules with or without intranasal oxymetazoline is the first-line treatment. Acute sinusitis can develop postoperatively and can be managed conservatively with sinonasal irrigations but may require antibiotic therapy. Both complications would typically be managed by the operating surgeon.

Cerebrospinal fluid (CSF) leak is a rare but severe complication of FESS. A leak should be suspected in cases of unilateral clear, dripping rhinorrhea, likened to a leaky faucet. This is typically worsened when bending forward and may be associated with a salty-metallic taste and headache. If CSF leak is suspected, the clear nasal drainage should be collected to test for beta-2 transferrin protein. Urgent communication with the operating surgeon and/or consultation with otolaryngology is warranted.[33]

Differential diagnosis of rhinosinusitis

Symptoms of rhinosinusitis overlap with symptoms of other common rhinologic conditions. A retrospective cohort study in a large health care center found that most patients diagnosed with CRS by non-otolaryngologists do not meet diagnostic criteria.[34] For patients presenting with rhinologic symptoms who do not meet criteria for rhinosinusitis, alternative diagnoses should be considered. The remainder of this article will address alternative diagnoses that are commonly mistaken for rhinosinusitis.

Allergic rhinitis

Clinical presentation. Allergic rhinitis (AR) is defined as immunoglobulin E (IgE)-mediated inflammation of the nasal cavity mucosa after exposure to an inhaled allergen.[35] Patients typically present with nasal congestion, rhinorrhea, sneezing, ocular erythema, and itching of the nose, eyes, palate, or ears. A thorough history should assess exposure-associated factors, including temporal (seasonal vs perennial) and spatial (indoor vs outdoor) correlations. Seasonal symptoms are often triggered by exposure to outdoor allergens such as spores and pollens, and perennial symptoms with indoor allergens such as dust mites, pet dander, and mold. A family history of AR or history of other atopic diseases is common.[36]

On physical examination, patients may exhibit bilateral clear rhinorrhea, pale and edematous nasal mucosa, a hyperpigmented nasal crease, epiphora, erythematous and edematous conjunctiva, discolored lower eyelids (allergic shiners), otitis media with effusion,[37] and throat clearing. Routine imaging is not recommended for patients with a clinical presentation consistent with AR.[38]

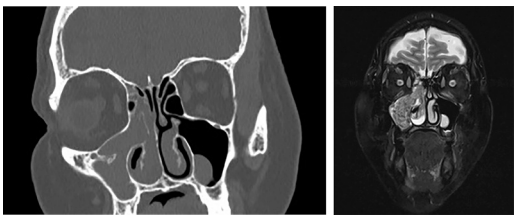
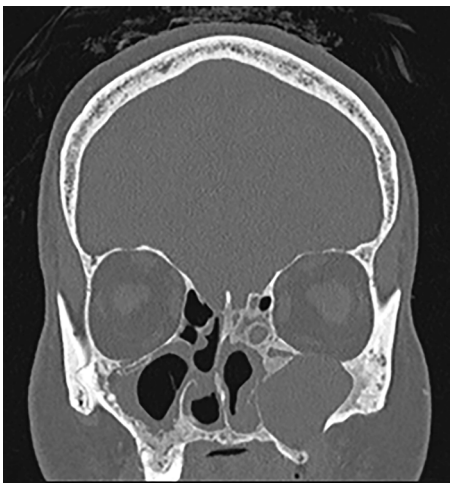
Treatment. Empiric treatment of AR involves environmental controls, allergen avoidance, and medical management. INCS are the first-line therapy for AR due to their high efficacy and excellent safety profile. INCS are superior to oral antihistamines in improving nasal symptoms and quality of life in patients with AR.[39] They also alleviate allergic ocular symptoms by suppressing the nasal-ocular reflex.[40]

It has long been accepted that there are no significant differences in efficacy between available agents. The onset of action for INCS is quite slow, and it may take 1 week or longer of consistent, daily use to reach maximal benefit.[41] Patients must be counseled on this aspect of INCS to avoid cessation during the first week of use when improvement may be minimal. While daily use is most effective, as-needed use of INCS is still more efficacious than placebo.[42]

Oral second generation H1-antihistamines, such as cetirizine, fexofenadine, loratadine, and levocetirizine, are effective in alleviating nasal and ocular symptoms caused by AR and serve as an appropriate alternative first-line therapy for mild to moderate AR.[35] In patients with moderate to severe AR symptoms with inadequate control on INCS monotherapy, INCS with intranasal antihistamine (INAH) provides superior symptom control when compared with either as monotherapy.[43]

The most common side effects of medicated nasal sprays are local irritation (dryness, burning, etc) and epistaxis.[44] Epistaxis can be minimized with proper positioning and administration, generally pointed away from the septum by utilizing the cross-hand

Table 1
Other differential diagnoses that mimic rhinosinusitis

	Pathophysiology	Clinical Presentation	Imaging
Neoplasm	Overgrowth of abnormal cells	Cranial nerve deficits, facial or nasal mass, proptosis, epistaxis, nasal obstruction	
Mucocele[54]	Obstructed sinus fills with mucus leading to expansion, bony erosion, and impingement of nearby structure	Nasal obstruction, facial pressure or pain, facial swelling	

Empty nose syndrome[55]	Not fully understood but can occur after sinonasal surgery, particularly of the turbinates, potentially related to disrupted airflow sensory mechanisms	Paradoxic nasal obstruction when nasal passages are widely patent

technique, that is, applying nasal sprays to each nostril with the contralateral hand. Nasal saline irrigation is a safe adjunct therapy in both children and adults.[45]

Therapies such as first-generation oral antihistamines (diphenhydramine), oral or intramuscular corticosteroids, intranasal decongestions (regular use), and leukotriene receptor antagonists (except in patients with comorbid asthma) are not recommended due to their inferior efficacy and significant side effects, including a black box warning for suicidal ideation/action for montelukast.[35,38]

Indications for specialist referral. Referral to an allergist or otolaryngologist should be considered for patients who are not responsive to consistent empiric therapy after 2 to 4 weeks, those in whom allergen avoidance is not possible, or when diagnostic confirmation is needed.[35] Serum-specific IgE testing (also called in vitro testing) or skin allergy testing can guide further management and inform decisions regarding immunotherapy.[46] In patients with persistent nasal obstruction due to anatomic factors such as septal deviation or turbinate hypertrophy, surgical intervention (septoplasty, inferior turbinate reduction) may be considered.

Nonallergic rhinitis

Nonallergic rhinitis (NAR) encompasses a range of non-IgE-mediated conditions, including vasomotor rhinitis (VMR), gustatory rhinitis, NAR with eosinophilia syndrome, atrophic rhinitis, age-related rhinitis, drug-induced rhinitis (including rhinitis medicamentosa), and pregnancy-related rhinitis.[47]

Vasomotor rhinitis. The most common form of NAR is VMR, a diagnosis of exclusion characterized by thin, clear anterior rhinorrhea without significant symptoms of AR (sneezing or ocular symptoms).[38] Symptoms are often triggered by eating, bowel movements, or hygiene activities like brushing teeth. Environmental factors, such as temperature changes, strong odors, irritants, alcohol, exercise, or hormonal fluctuations may also lead to symptoms.[48] The pathophysiology is believed to involve autonomic dysfunction and an imbalance between the parasympathetic and sympathetic activity in nasal mucosa.[49] VMR is more common as individuals' age and worsens with cognitive decline or neurologic conditions and insults. This condition is underrecognized and should be considered in patients with rhinorrhea without other AR symptoms or in patients who do not improve with therapies for AR.

Treatment for nonallergic rhinitis. First-line treatment for patients with rhinorrhea-predominant symptoms is intranasal anticholinergic therapy with ipratropium bromide.[50] For patients with predominate nasal obstruction, INCS and INAH are recommended.[51,52] Patients with persistent or severe symptoms that do not respond to medical therapy should be referred to an otolaryngologist for further evaluation and consideration of procedural interventions such as posterior nasal nerve ablation.[53]

By distinguishing allergic from NAR and recognizing appropriate treatment pathways, non-otolaryngologists can optimize symptom control and identify patients who may benefit from specialist referral.

Less common pathologies

Several other disease processes may mimic symptoms of rhinosinusitis, including neoplasms, mucoceles, and empty nose syndrome. **Table 1** briefly summarizes pathophysiology and clinical presentation of these conditions.

Clinicians should maintain a broad differential when evaluating persistent nasal obstruction, headache, and facial pressure, especially when a patient presents with unilateral symptoms and imaging findings.

SUMMARY AND CLINICS CARE POINTS

1. Distinguishing Acute versus Chronic Rhinosinusitis is Key
   - Acute rhinosinusitis (ARS) is classified as symptoms lasting ≤4 weeks, with bacterial ARS diagnosed based on persistent symptoms beyond 10 days or "double worsening." First-line treatment includes supportive care, with antibiotics reserved for bacterial cases with severe, persistent symptoms. Imaging is only necessary for suspected complications.
   - Chronic rhinosinusitis (CRS) is defined by ≥12 weeks of symptoms with objective evidence of inflammation. It is further categorized into CRS with and without nasal polyps, with different treatment strategies based on inflammatory pathways.
2. Medical Management is the Foundation of Treatment
   - ARS and CRS management begins with nasal saline irrigations and intranasal corticosteroids. Systemic steroids may be used short-term for CRS with nasal polyps (CRSwNP), and antibiotics should be reserved for bacterial infections.
   - Biologic therapies are available for CRSwNP that is refractory to standard medical and surgical therapies and may be a helpful adjunct in patients with comorbid asthma.
3. Referral to Otolaryngology is Necessary for Persistent or Complicated Cases
   - ARS complications (eg, orbital/intracranial extension) require urgent otolaryngology consultation and possible surgical intervention.
   - CRS refractory to medical therapy should be evaluated for endoscopic sinus surgery, particularly if symptoms persist despite 4 to 12 weeks of medical treatment.

DISCLOSURE

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SUPPLEMENTARY DATA

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