INTRODUCTION — Acute rhinosinusitis (ARS) is defined as symptomatic inflammation of the nasal cavity and paranasal sinuses lasting less than four weeks. The term "rhinosinusitis" is preferred to "sinusitis" since inflammation of the sinuses rarely occurs without concurrent inflammation of the nasal mucosa [1].

The most common etiology of ARS is a viral infection associated with the common cold. Viral rhinosinusitis is complicated by acute bacterial infection in only 0.5 to 2.0 percent of episodes [2]. Uncomplicated acute viral rhinosinusitis (AVRS) typically resolves in 7 to 10 days. Acute bacterial rhinosinusitis (ABRS) may also be a self-limited disease. Rarely, patients with untreated bacterial disease may develop serious complications. (See "Acute sinusitis and rhinosinusitis in adults: Clinical manifestations and diagnosis", section on 'Classification of rhinosinusitis'.)

Distinguishing AVRS related to colds and influenza-like illnesses from bacterial infection is a challenge frequently faced by the primary care clinician. Antibiotics are indicated for ABRS, but are ineffective and not recommended for AVRS. Despite the overwhelming prevalence of a viral etiology, however, in the late 1990s, 92 percent of patients in the United Kingdom [3] and 85 to 98 percent of patients in the United States (US) [4] were prescribed an antibiotic when seen for an
upper respiratory or sinus infection. Initiatives to limit the use of antibiotics for upper respiratory infections are ongoing in Europe and the United States [5].

This topic will address the treatment of acute rhinosinusitis. The clinical manifestations and diagnosis of acute rhinosinusitis are discussed separately. (See "Acute sinusitis and rhinosinusitis in adults: Clinical manifestations and diagnosis".)

**APPROACH TO TREATMENT** — The goals of treatment for acute rhinosinusitis (ARS) are different, depending on whether the source of infection is viral or bacterial. Management of acute viral rhinosinusitis (AVRS) aims to relieve symptoms of nasal obstruction and rhinorrhea; treatment does not shorten the clinical course of the disease. Treatment for acute bacterial rhinosinusitis (ABRS) includes antibiotics to eliminate the infection and prevent complications.

Studies suggest that 40 to 69 percent of patients with ABRS may clear their infection spontaneously [6-8]. In most of these studies, however, the diagnosis of acute bacterial infection was not confirmed by sinus aspirate culture, but rather was based upon clinical criteria. The populations studied were therefore likely to include patients with viral infection. Thus, the actual rate of spontaneous resolution of bacterial infection is not certain, but likely to be lower than the reported 40 to 60 percent.

It is generally not possible to distinguish AVRS from ABRS in the first 10 days of illness based upon history, examination, or radiologic study. The diagnosis of ABRS is usually clinical, since sinus aspirates for culture are not readily obtainable. ABRS should be suspected in patients presenting with any of the following three features [9]:

- Persistent symptoms or signs of ARS lasting 10 or more days with no clinical improvement
- Onset with severe symptoms (fever >39˚C or 102˚F and purulent nasal discharge or facial pain) lasting at least three consecutive days at the beginning of illness
- Onset with worsening symptoms following a viral upper respiratory infection that lasted five to six days and was initially improving

(See "Acute sinusitis and rhinosinusitis in adults: Clinical manifestations and diagnosis", section on 'Distinguishing bacterial from viral infection'.)

Since AVRS is expected to resolve within 10 days and ABRS may also resolve spontaneously within the first 10 days, patients who present with fewer than 10 days of symptoms in general should be managed with supportive care [10]. In a systematic review of 10 trials involving patients with uncomplicated acute sinusitis and a normal immune system, antibiotics slightly shortened the time to cure (number needed to treat for benefit 18) but increased the incidence of adverse effects (number needed to treat for harm 8) [11].

**SYMPTOMATIC THERAPY FOR ACUTE RHINOSINUSITIS** — Acute viral rhinosinusitis (AVRS) is a self-limited process and treatment is aimed at symptom relief. Acute bacterial rhinosinusitis (ABRS) should be treated with antibiotics, but adjunctive therapy for management of symptoms is also indicated.

**Analgesics** — Analgesics such as nonsteroidal antiinflammatories andacetaminophen are recommended for pain relief.
Saline irrigation — Mechanical irrigation with buffered, physiologic, or hypertonic saline may reduce the need for pain medication and improve overall patient comfort, particularly in patients with frequent sinus infections [12]. The evidence supporting use of saline irrigation is limited but indicates some decrease in time lost from work and symptom relief with minor adverse effects, including nasal burning and irritation. It is important that irrigants be prepared from sterile or bottled water, as there have been reports of amebic encephalitis due to tap water rinses [13]. Instructions for preparing a rinse solution are shown in a table [table 1].

Topical glucocorticoids — The theoretic mechanism of action for intranasal glucocorticoids (corticosteroids) is a decrease in mucosal inflammation that allows improved sinus drainage. Studies evaluating topical glucocorticoids should be interpreted with caution, as many studies contain both heterogeneous patient populations (acute, chronic, and/or viral rhinosinusitis) and different treatment regimens (concomitant decongestant, saline irrigation, antibiotic).

Studies of topical glucocorticoids have demonstrated some benefit for the relief of symptoms in ARS, both viral and bacterial. A meta-analysis of three studies, involving patients with ARS diagnosed by symptoms and confirmed by radiologic or endoscopic studies, found that use of intranasal steroids, alone or as adjuvant therapy to antibiotics, increased the rate of symptom response compared to placebo (RR 1.11, 95% CI 1.04-1.18) [14]. Symptom resolution was greater for patients receiving intranasal glucocorticoids than placebo, and a dose response was observed, comparing mometasone furoate 200 and 400 mcg. When used as an adjunct to antibiotic therapy in the treatment of ABRS, a meta-analysis of placebo-controlled trials suggests that 15 patients would need to be treated with intranasal glucocorticoids to improve clinical symptoms in one patient. One randomized study of patients with ABRS did not demonstrate benefit for intranasal glucocorticoids [15]. Subgroup analysis of this study, however, found that patients with less-severe symptoms did benefit, possibly because thicker nasal secretions and closed ostia in patients with more severe illness limit penetrance of the topical steroids.

Intranasal glucocorticoids are likely to be most beneficial for patients with underlying allergic rhinitis.

Topical decongestants — The use of topical decongestants, such as oxymetazoline, may provide a subjective sense of improved nasal patency. However, there is some concern that topical decongestants themselves may provoke mucosal inflammation, at least in an experimental animal model [16]. If used, topical decongestants should be used sparingly (no more than three consecutive days) to avoid rebound congestion [17]. Topical decongestants are suggested for symptomatic relief in the treatment of AVRS [18]. However, they have little effect as adjunctive therapy to antibiotics in the treatment of ABRS, and 2012 guidelines advise that they are not helpful in patients with ABRS [1].

Oral decongestants — Oral decongestants are frequently used to reduce edema and facilitate aeration and drainage. Consistent reports on their efficacy are lacking, however. Some [19,20], but not all [21], studies have demonstrated improved patency of the nasal airway and sinus ostia. One randomized trial compared several oral decongestants (ephedrine sulfate 25 mg, pseudoephedrine HCL 60 mg, phenylephrine HCL 10 mg, and phenylpropanolamine HCL 25 mg) with placebo; only ephedrine was superior to placebo in this trial [22]. Similar to their recommendations against topical formulations, 2012 guidelines advise that oral decongestants are not helpful in patients with ABRS [1].
When eustachian tube dysfunction is a significant confounding factor in AVRS, a short course (three to five days) of oral decongestants may be warranted. Oral decongestants should be used with caution in patients with cardiovascular disease, hypertension, or benign prostate hypertrophy due to systemic adverse effects with oral alpha adrenergic preparations [23].

**Antihistamines** — Antihistamines are frequently prescribed for symptom relief due to their drying effects; however, there are no studies investigating their efficacy for this indication [18]. Additionally, over-drying of the mucosa may lead to further discomfort. Antihistamines have side effects (drowsiness, xerostomia), and their use for the treatment of acute sinusitis is not recommended [9].

**Mucolytics** — Mucolytics such as guaifenesin serve to thin secretions and may promote ease of mucus drainage and clearance; however, no published trials exist to definitively support their use [18].

**COMMUNITY-ACQUIRED ACUTE BACTERIAL RHINOSINUSITIS** — For patients who present with 10 or more days of symptoms (purulent rhinorrhea, nasal congestion, and facial pressure), the likelihood of a diagnosis of ABRS is increased. (See "Acute sinusitis and rhinosinusitis in adults: Clinical manifestations and diagnosis", section on 'Distinguishing bacterial from viral infection' and 'Approach to treatment' above.)

**Observation** — Patients who are diagnosed with ABRS should be treated with antimicrobial therapy. However, the diagnosis of a bacterial process is often uncertain, and watchful waiting with assurance of follow-up may be appropriate for some patients with milder symptoms. Guidelines from a multidisciplinary expert panel in 2007 recommend that selected patients with symptoms suggestive of mild ABRS (only mild pain and temperature <38.3°C or 101°F) may be managed expectantly [18]. Patients under observation should be treated supportively for relief of symptoms for seven days after the time, antimicrobial therapy is then initiated. Guidelines from the Infectious Disease Society of America (IDSA) in 2012 recommend that antimicrobial therapy might be withheld for three days in patients with mild symptoms, but initiated promptly thereafter if there is no improvement [9]. Factors such as age, general state of health, and comorbidities should be considered when choosing this option.

**Patients with moderately severe symptoms who meet clinical criteria for ABRS and patients with severe symptoms regardless of duration of illness should be treated with an antibiotic.** Guidelines from the IDSA in 2012 recommend initiation of antibiotic therapy when ABRS is diagnosed by standardized criteria [9]. The rationale is to shorten the duration of illness, relieve symptoms, and prevent recurrent infection or complications. An algorithm for the treatment of acute bacterial rhinosinusitis is shown (algorithm 1). (See 'Antimicrobials' below.)

**Antimicrobials** — Several studies and meta-analyses have addressed the efficacy of systemic antibiotics in the treatment of acute rhinosinusitis (ARS). Given the difficulty in distinguishing viral from bacterial infection, these studies are complicated by heterogeneity in patient symptoms, underlying etiology, and outcomes of treatment.

- A randomized trial of adult patients (n = 166) presenting to primary care offices who met clinical criteria for acute bacterial rhinosinusitis (ABRS) evaluated whether a 10-day course of amoxicillin, compared to placebo, improved disease-related quality of life as measured by
a symptom score [24]. There was no difference between groups at day 3, the primary specified outcome, or at day 10, although there was greater symptom improvement reported by the amoxicillin group at day 7. All patients were also offered symptomatic treatment for relief of pain, fever, cough, and nasal congestion.

- A 2008 meta-analysis based upon individual patient data (n = 2547) from nine randomized trials found that 15 patients with rhinosinusitis would need to be treated with antibiotics before one additional patient would be cured [25]. Clinical signs and symptoms did not define a patient subgroup that was more likely to benefit from treatment or distinguish viral from bacterial infection.
- A 2012 meta-analysis of 13 randomized trials in adults with ABRS (n = 2878) found that 13 patients (95% CI 9-22) would need to be treated with antibiotics for one to benefit [9].
- A 2008 meta-analysis pooled results from 17 randomized trials in which acute sinusitis was variably diagnosed (the majority by clinical criteria, but also imaging, microbiology, and inflammatory markers) [7]. There was variability in choice of antibiotic, use of ancillary therapy, and inclusion of children (three studies). Compared to placebo, antibiotics were associated with a higher rate of cure or symptom improvement at 7 to 15 days (OR 1.64, 95% CI 1.35-2.0), but the magnitude of effect was moderate (cure or improvement in 77 percent with antibiotics versus 68 percent with placebo). The 9 percent difference in cure/improvement rate with antibiotic therapy was at the expense of an 8 percent increase in adverse effects, mostly gastrointestinal (30 versus 22 percent for placebo-treated patients).
- A meta-analysis that analyzed data from five trials comparing antibiotics to placebo, defining failure as lack of cure or improvement at 7 to 15 days follow-up, found an increased response rate for antibiotics (RR 0.66, 95% CI 0.44-0.98) [26]. Eighty percent of the participants not treated with antibiotics and 90 percent of the antibiotic group improved within two weeks. No one antibiotic was superior to another in the review of 51 studies comparing antibiotics.

Choice of antibiotic — When antibiotics are administered, treatment is most often initiated empirically. Although culture-guided therapy is optimal, obtaining suitable cultures requires endoscopy or antral puncture and is generally reserved for patients with complications. (See "Acute sinusitis and rhinosinusitis in adults: Clinical manifestations and diagnosis", section on 'Diagnostic tests'.)

Most comparative studies of antibiotics for the treatment of ABRS do not involve patients with culture-defined infection and therefore include patients who meet predefined clinical criteria but who may not have bacterial infection. The significant rate of spontaneous recovery in mixed populations of AVRS and ABRS decreases the ability of studies to differentiate between less-effective and more-effective antibiotics (the apparent response to less-effective antibiotics is greater than would be seen in a more strictly defined ABRS population; conversely, the relative effectiveness of more appropriate antibiotics is diminished). Thus, the finding in multiple studies of equivalent effectiveness among antibiotics is called into some question [8,26-30].

Amoxicillin has been recommended as a first-line agent in the past because of its narrow spectrum and relative low cost. However, there is increasing emergence of antimicrobial resistance among respiratory pathogens, including pneumococci and H. influenzae. Resistance rates vary regionally, with the prevalence of H. influenzae resistance ranging from 27 to 43
percent in the US [9]. Additionally, the introduction of routine conjugated pneumococcal vaccination in children has changed the spectrum of bacterial infection. In both adults and children, the percentage of ABRS due to S. pneumoniae has decreased while the proportion of ABRS due to H. influenzae has increased.

The addition of clavulanate to **amoxicillin** improves coverage for ampicillin-resistant H. influenzae as well as M. catarrhalis. While evidence is stronger in children than adults to support use of **amoxicillin-clavulanate** instead of amoxicillin, the IDSA 2012 guidelines makes the following recommendations regarding antimicrobial treatment of ABRS in adults [9]:

- **Amoxicillin-clavulanate** rather than **amoxicillin** is recommended as empiric therapy for non-penicillin allergic adults. Amoxicillin-clavulanate is also preferred to a respiratory fluoroquinolone as initial empiric therapy. The dose of amoxicillin-clavulanate for most patients would be either 500 mg/125 mg orally three times daily or 875 mg/125mg orally twice daily.

- High-dose **amoxicillin-clavulanate** (2 g orally twice daily) is recommended in geographic regions with rates of penicillin-nonsusceptible S. pneumonia exceeding 10 percent and for patients who meet any of the following criteria: 65 years and older, recently hospitalized, treated with an antibiotic in the previous month, or immunocompromised.

- **Doxycycline** is a reasonable alternative for first-line therapy and can be used in patients with penicillin allergy. A respiratory fluoroquinolone (levofloxacin or moxifloxacin) is another option for penicillin-allergic patients.

- Macrolides (clarithromycin or azithromycin), trimethoprim-sulfamethoxazole, and second- or third-generation cephalosporins are **not** recommended for empiric therapy because of high rates of resistance of S. pneumoniae (and of H. influenzae for trimethoprim-sulfamethoxazole).

- Routine coverage for S. aureus or methicillin-resistant S. aureus (MRSA) is not indicated at this time. Despite the prevalence of staphylococcal colonization in the middle meatus in health adults, S. aureus remains an uncommon cause of ABRS [31].

Local and regional histograms of bacterial resistance should be referenced to understand resistance trends in the local community.

The recommendation to treat with **amoxicillin-clavulanate** rather than a respiratory fluoroquinolone is based upon studies showing equivalent effectiveness in patients with culture-documented infection [32] and a need to limit the overuse of fluoroquinolones in an effort to slow the development of resistance to this antibiotic class.

Pregnant patients can be treated with **amoxicillin-clavulanate** (class B); pregnant patients who are penicillin-allergic would need to be treated with **azithromycin** (class B), as **doxycycline** (class D) and fluoroquinolones (class C) are not options in pregnancy.

**Duration for initial treatment** — The IDSA guidelines advise a 5 to 7 day course of antibiotics (rather than 10 to 14 days) in adults. In one meta-analysis of 12 randomized trials of ABRS in adults, no difference was noted in response rates or relapse rates comparing short courses (3 to 7 days) and longer courses (6 to 10 days) of antibiotics [33]. Rates of adverse events were lower for 5 day compared with 10 day courses. However, there was heterogeneity in the trials in terms of symptom duration and use of adjunctive medications. Studies of antimicrobial response, based
upon sinus aspirate cultures in children, indicate bacterial eradication within 72 hours for appropriate antimicrobial treatment [34], supporting a shorter antibiotic course than has traditionally been advised.

**Systemic glucocorticoids** — A systematic review and meta-analysis of four randomized trials in adults with acute sinusitis (n = 1008) found that systemic glucocorticoids plus antibiotic, compared with antibiotic plus placebo or, in one trial, a nonsteroidal anti-inflammatory, resulted in improved symptom control at days three to seven (risk ratio, RR 1.4, 95% CI 1.1-1.8) [35]. Radiologic findings consistent with acute sinusitis were part of the diagnostic criteria in three studies. These data are limited by the potential for attrition bias and the lack of long-term follow-up on the effects of steroids. In a subsequent randomized trial, oral prednisolone 30 mg daily for seven days was not more effective than placebo in reducing facial pain or pressure on day seven for adult patients with clinically diagnosed acute rhinosinusitis [36].

Unlike topical glucocorticoids, systemic glucocorticoids possess a significant side effect profile, including hyperglycemia, hypertension, increased appetite, mood changes, and insomnia, as well as effects on bone metabolism and cataract formation with more chronic exposure. We suggest not using systemic glucocorticoids in the outpatient treatment of acute rhinosinusitis pending the availability of additional data from higher-quality trials. (See "Major side effects of systemic glucocorticoids".)

**Treatment failure** — Patients with ABRS are expected to show some response to empiric antimicrobial therapy after three to five days. An alternative treatment strategy is indicated for patients with ABRS who fail to show some improvement in that time frame, or in whom symptoms worsen after at least two to three days of therapy. Experimental evidence indicates bacterial eradication by day three [37,38] and studies have correlated clinical and bacteriologic response [39]. Although older adults or those with multiple morbidities may take longer to resolve infection, such individuals should also show some symptom improvement within five days of initiating antimicrobial therapy for ABRS [9].

Reasons for treatment failure include resistant pathogens, inadequate dosing, structural abnormalities, or a noninfectious etiology. Patients who fail first-line therapy require alternative antibiotic selection. Ideally, an endoscopically-guided culture could be performed to redirect antibiotic therapy, although this is often impractical. Options for second-line therapy provide a broader spectrum of activity and/or a different class of agent.

**Guidelines from the IDSA recommend the following options for empiric second-line treatment. If improvement is seen within 3 to 5 days of initiation of therapy, a total course duration of 7 to 10 days is recommended:**

- **Amoxicillin-clavulanate** 2000 mg/125 mg orally twice daily
- **Levofloxacin** 500 mg orally once daily
- **Moxifloxacin** 400 mg orally once daily

Patients with severe infection requiring hospitalization could be treated with one of the following: a respiratory fluoroquinolone (levofloxacin or moxifloxacin in doses above, either orally or intravenously) or intravenous amoxicillin-sulbactam 1.5 to 3.0 g every six hours, ceftriaxone 1 to 2 g every 24 hours, or cefotaxime 2 g every four to six hours. Although specific recommendations from the IDSA are not available, we suggest that intravenous antibiotics be given until there is
clear evidence of patient response, at which time the patient could be discharged on an oral antibiotic with similar activity to complete a 10-day course. If there is no response to intravenous antibiotics within 48 hours of hospitalization, a CT scan should be performed to verify the diagnosis and to evaluate for suppurative complications (e.g., orbital cellulitis, intracranial abscess) and an ENT consultation requested to obtain sinus cultures and for consideration of the need for surgical intervention.

A CT scan of the sinuses is indicated if symptoms worsen or fail to improve. For patients who have failed to respond to both first- and second-line therapy, sinus cultures should be obtained either by direct aspirate or endoscopy of the middle meatus; nasopharyngeal cultures are not reliable.

Relapse after treatment — Recurrence of symptoms within two weeks of response to initial treatment usually represents inadequate eradication of infection. Patients who had a good response to initial therapy and who have mild symptoms of relapse can be treated with a longer course of the same antibiotic. Patients who had only minimal symptom response with the initial antibiotic or whose relapse is moderate to severe, however, are more likely to have organisms resistant to the initial empiric antibiotic and would require a change in the drug selected. The recommended duration of antibiotic treatment for relapse has not been addressed by published guidelines. The treatment duration should be guided by the goal of full resolution of symptoms. If symptoms persist despite a repeat 7- to 10-day course of antibiotics, referral to an otolaryngologist is warranted.

Patients who had only minimal symptom response with the initial antibiotic or whose relapse is moderate to severe, however, are more likely to have organisms resistant to the initial empiric antibiotic and would require a change in the drug selected. (See 'Treatment failure' above.)

INDICATIONS FOR SPECIALTY REFERRAL — Early referral is essential for patients whose symptoms indicate the need for urgent endoscopy or surgical biopsy, or for diagnostic testing (imaging or immunologic testing) that couldn’t be performed where they have initially presented. Such patients include those with severe infection (high persistent fever, orbital edema, severe headache, visual disturbance, altered mental status, or meningeal signs), those in whom fungal sinusitis or granulomatous disease is suspected, and those with nosocomial infection.

Patients with identified anatomic defects causing obstruction require referral for surgery. Patients who are immunocompromised or are found to have unusual or resistant pathogens might benefit from consultation with an infectious disease specialist. Additionally, referral is indicated for patients with ABRS who have failed to respond to first- and second-line antimicrobial therapy.

The 2012 IDSA guidelines have developed consensus recommendations about indications for less-urgent specialty referral as follows:

- Multiple recurrent episodes of ABRS (three to four episodes per year)
- Chronic rhinosinusitis (with or without polyps or asthma) with recurrent exacerbations of ABRS
- Patients with allergic rhinitis who may be candidates for immunotherapy

SURGERY — There is no indication for surgery in patients with uncomplicated ABRS. However, surgery may be emergently indicated in patients experiencing extra-sinus complications of ABRS.
including orbital abscess, epidural abscess, meningitis, and brain abscess. Surgical debridement is also indicated for the treatment of acute invasive fungal rhinosinusitis, a condition for which mortality rates remain high despite timely debridement and systemic antifungal therapy. (See "Fungal rhinosinusitis").

Indications for surgery in patients with chronic rhinosinusitis are discussed separately. (See "Management of chronic rhinosinusitis", section on 'Indications for surgery'.)

INFORMATION FOR PATIENTS — UpToDate offers two types of patient education materials, “The Basics” and “Beyond the Basics.” The Basics patient education pieces are written in plain language, at the 5th to 6th grade reading level, and they answer the four or five key questions a patient might have about a given condition. These articles are best for patients who want a general overview and who prefer short, easy-to-read materials. Beyond the Basics patient education pieces are longer, more sophisticated, and more detailed. These articles are written at the 10th to 12th grade reading level and are best for patients who want in-depth information and are comfortable with some medical jargon.

Here are the patient education articles that are relevant to this topic. We encourage you to print or e-mail these topics to your patients. (You can also locate patient education articles on a variety of subjects by searching on "patient info" and the keyword(s) of interest.)

- **Basics topics** (see "Patient information: Sinusitis in adults (The Basics)" and "Patient information: What you should know about antibiotics (The Basics)"
- **Beyond the basics topics** (see "Patient information: Acute sinusitis (sinus infection) (Beyond the Basics)"

SUMMARY AND RECOMMENDATIONS

- It is generally not possible to distinguish viral from bacterial acute rhinosinusitis (ARS) in the first 10 days of illness. Acute bacterial rhinosinusitis (ABRS) should be suspected in patients presenting with any of the following three features: 1) persistent symptoms or signs of ARS lasting 10 or more days with no clinical improvement; 2) onset with severe symptoms (fever >39˚C or 102˚F and purulent nasal discharge or facial pain) lasting at least three consecutive days at the beginning of illness; 3) onset with worsening symptoms following a viral upper respiratory infection that lasted five to six days and was initially improving. Management of acute viral rhinosinusitis (AVRS) aims to relieve symptoms of nasal obstruction and rhinorrhea; treatment for ABRS includes antibiotics to eliminate the infection and prevent complications. (See ‘Approach to treatment’ above.)

- **AVRS is expected to resolve within 10 days**: ABRS may also resolve spontaneously within the first 10 days. Patients who present with fewer than 10 days of symptoms, in the absence of high fever or symptoms suggesting complicated illness, should be managed with supportive care. We suggest mild analgesics, saline nasal irrigation, and fluid (Grade 2C). We suggest treatment with intranasal glucocorticoids (Grade 2B). Decongestants may be useful when eustachian tube dysfunction is a factor for patients with AVRS, but are not likely to be helpful for patients with ABRS and have adverse side effects. We suggest not treating symptoms with antihistamines (Grade 2C). (See ‘Symptomatic therapy for acute rhinosinusitis’ above.)
We recommend treatment with an antibiotic for patients whose clinical symptoms meet criteria for ABRS (algorithm 1) (Grade 1B). In light of increasing microbial resistance to antibiotics, we suggest initial empiric treatment with amoxicillin-clavulanate rather than macrolides (clarithromycin or azithromycin), trimethoprim-sulfamethoxazole, or oral second- or third-generation cephalosporins (Grade 2B). For most patients, amoxicillin-clavulanate (either 500mg/125 mg orally three times daily or 875 mg/125 mg orally twice daily) should be given for five to seven days. Doxycycline is a reasonable alternative for first-line therapy and can be used in patients with penicillin allergy. A respiratory fluoroquinolone (levofloxacin or moxifloxacin) is another option for penicillin-allergic patients. (See 'Choice of antibiotic' above and 'Duration for initial treatment' above.)

Local and regional histograms of bacterial resistance should be referenced to understand resistance trends in the local community. (See 'Choice of antibiotic' above.)

Patients with ABRS are expected to show some response to empiric antimicrobial therapy after three to five days. An alternative treatment strategy is indicated for patients with ABRS who fail to show some improvement in that time frame, or in whom symptoms worsen after at least two to three days of therapy. Options for second-line empiric therapy include high-dose amoxicillin-clavulanate (2000 mg/125 mg orally twice daily) or a respiratory fluoroquinolone (levofloxacin 500 mg orally once daily or moxifloxacin 400 mg orally once daily). (See 'Treatment failure' above.)

Specialty referral on an urgent basis is indicated for patients with severe infection (high persistent fever, orbital edema, severe headache, visual disturbance, altered mental status, or meningeal signs), those in whom fungal sinusitis or granulomatous disease is suspected, and those with nosocomial infection. Referral is also indicated for patients with obstructive anatomic defects, immunocompromise, resistant pathogens, or failure to respond to first- and second-line antimicrobial therapy. (See 'Indications for specialty referral' above.)

There is no indication for surgery in patients with uncomplicated ABRS. However, surgery may be emergently indicated in patients experiencing extra-sinus complications of ABRS, including orbital abscess, epidural abscess, meningitis, and brain abscess. (See 'Surgery' above.)