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ANTIBIOTIC OVERUSE IN RHINOSINUSITIS AND ITS ASSOCIATED RISKS - REVIEW

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ABSTRACT

Rhinosinusitis is a common condition, affecting a large number of patients. In the vast majority of cases, the origin is viral. Results of the studies included in this article indicate that only 0.5-2% of all cases have bacterial etiology. Despite these facts, antibiotics are still widely prescribed for this condition. The aim of this study is to examine antibiotic overuse in rhinosinusitis and potential consequences of this practice.

This review paper was based on resources available in the PubMed database; articles were identified using the following keywords: “rhinosinusitis AND antibiotic resistance”, “rhinosinusitis AND antibiotic overuse” and “acute rhinosinusitis.”. All included articles were published between 2020-2026.

Results indicate that overuse of antibiotics in rhinosinusitis is a common practice in many countries. Increasing antibiotic resistance, along with the spread of multi-drug resistant microbes is one of the major consequences. Recent findings highlight the role of the respiratory microbiota and indicate that antibiotic therapy induces long-term changes in the nasal microbiome. Research shows that there are no significant differences in clinical effectiveness between amoxicillin and amoxicillin-clavulanate.

In conclusion, antibiotic overuse in rhinosinusitis is a prevalent trend and it poses an important problem of public health. Further research is needed to better understand this issue. The implementation of educational programs and development of clear treatment guidelines may help address this problem.

KEYWORDS

Rhinosinusitis, Antibiotic Resistance, Antibiotic Overuse, Acute Rhinosinusitis

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Introduction

Rhinosinusitis is defined as inflammation of the nasal cavity and paranasal sinuses (Romano et al., 2024). This condition is very common, affecting a large number of patients. Acute rhinosinusitis has a one-year prevalence of 6-15% and 5-12% of the general population suffer from chronic rhinosinusitis (Fokkens et al., 2020).

According EPOS 2020 (European Position Paper on Rhinosinusitis and Nasal Polyps 2020), rhinosinusitis should be diagnosed when patient shows nasal blockade or discharge (anterior or posterior nasal drip) and either facial pain and pressure or reduction of smell. In addition, in endoscopic examination there should be signs of nasal polyps, mucopurulent discharge (primarily from middle meatus) and oedema or mucosal obstruction (also primarily in middle meatus). Changes and abnormality can also be shown in CT scan.

Symptoms of rhinosinusitis can be very troublesome for the patients- not only nasal obstruction and discharge, facial pain, but also disturbed sleep, fatigue and otalgia. Quality of life is impaired and patients seek effective treatment options. Besides the direct costs of treating this condition, there are also costs associated with patients' decreased productivity or absence from work (Orlandi et al., 2021).

In the vast majority of cases viruses are infectious agents of rhinosinusitis -rhinoviruses, influenza and parainfluenza viruses, adenoviruses, coronaviruses, RSV and others. (Kwon, Hathaway, Sutton, 2025). Bacterial etiology is relatively rare, accounting for only 0.5-2% of all cases in adults (Fokkens et al., 2020). Infections caused by other pathogens, like fungi, are uncommon and typically they are associated with specific groups of patients, for example those with HIV-positive status or individuals who use intranasal drugs (Kwon, Hathaway, Sutton, 2025).

In order to differentiate between bacterial and viral rhinosinusitis, specific symptoms must be considered. High fever, unilateral presentation, double sickening, more severe pain compared to viral infection, and elevated inflammatory markers raise suspicion of a bacterial etiology (Fokkens et al., 2020).

Similarities in symptoms between bacterial and viral infections during the initial phase of the illness, time limitations and, in some cases, the inability to re-examine patients may lead to antibiotic overuse in this

condition. Another reason for this practice is pressure from patients. Evidence suggests that many patients believe that antibiotics are an effective and rapid treatment for rhinosinusitis and expect an actual outcome from a medical consultation, namely an antibiotic prescription (Smith et al., 2023). Moreover, studies show that patients' demands are an important factor which influences physicians' treatment decisions, leading to antibiotic prescribing without clear medical indications (Christensen et al., 2025).

The discovery of antibiotics is one of the greatest milestones in medical history, paving the way for the treatment of infectious diseases. Morbidity and mortality from bacterial infections are significantly lower nowadays than in the pre-antibiotic era. However, the overuse and overprescription of antibiotics contribute to the emergence of multidrug-resistant microbes, which represents only one of the major threats. According to the World Health Organization (WHO) report (2025), in 2021 approximately 1.14 million deaths were caused by multidrug-resistant bacteria. Antimicrobial resistance is a serious healthcare problem and, according to some studies, may lead to another global pandemic (Aljeldah, 2022).

Despite effective guidelines and the viral origin of the vast majority of rhinosinusitis cases, antibiotics are still prescribed for this condition. The aim of this review article is to examine the overuse of antibiotics in rhinosinusitis and analyze the risks of this practice.

Methodology

This review article was based on resources published in the PubMed database between 2020 and 2026. English-language articles were searched using the following key terms: "rhinosinusitis AND antibiotic resistance", "rhinosinusitis AND antibiotic overuse" and "acute rhinosinusitis". Data obtained this way were analyzed and categorized according to key findings and research focus.

Results

Bittner and co-authors published results of a large retrospective cohort study conducted in Germany. The research group comprised 308,095 patients above 18 years old diagnosed with sinusitis by general practitioners (GPs) and ear, nose, throat specialists (ENTs). The authors used data from the Disease Analyzer database. The results showed that antibiotic were prescribed to 50.9% patients diagnosed by general practitioners and 50.0% of those diagnosed by ENT (Bittner et al., 2022).

A similar study was conducted in Ontario, Canada. In 2020, Schwartz et al. published the results of a descriptive analysis of unnecessary antibiotic prescriptions in primary care for 23 common conditions. Data about antibiotic overuse from the Electronic Medical Records Primary Care database were analyzed and compared with the expected prescribing rates. A total of 204,313 patients were included in the study. Overall, unnecessary antibiotic therapy was prescribed to 15.4% of patients. Antibiotics were most often overused in 3 of the 23 included conditions: acute bronchitis, acute sinusitis and acute otitis media. In the case of acute sinusitis, 48.4% of patients were given unnecessary antibiotic treatment, with the highest rate observed among those aged 19-64 years (50.1%). The authors of this analysis suggest that the rate of antibiotic prescribing can be reduced by 12-24%, and the easiest way to achieve this is by reducing antibiotic overuse in conditions where it is most prevalent, such as acute sinusitis (Schwartz et al., 2020).

Gessner et al. reported data on the amount of antibiotics generally prescribed in European countries. According to this study, these figures vary by region, with the highest numbers of packages sold per capita in Serbia, France and Ukraine (Gessner et al., 2023).

Arcimowicz (2024) highlights the issue of antibiotic resistance as a consequence of the overuse of antibiotics in the treatment of rhinosinusitis. The studies indicate a growing number of invasive strains. Concerns should be raised, particularly regarding certain Gram-negative bacteria that are resistant to nearly all known antibiotics (Arcimowicz, 2024). Some studies indicate that the COVID-19 pandemic and the increased use of antibiotics during this period contributed to the emergence of multidrug-resistant bacteria (Tourmkuney et al., 2022a, 2022b). The research revealed that strains of *Staphylococcus aureus* isolated from patients with chronic rhinosinusitis exhibit high levels of antibiotic resistance (Houtak, 2023). Moreover, recent studies emphasize the role of bacterial biofilms in the development of antibiotic resistance in this patient population (Houtak, 2023; Broderick, 2025).

The appropriate use of antibiotics is particularly important in patients with acute exacerbations of chronic rhinosinusitis, to reduce occurrence of resistant strains in their microbiota (Okifo, 2022). According to a study conducted in Poland, 35.6% of *Staphylococcus epidermidis* strains isolated from patients with chronic rhinosinusitis were multidrug-resistant. The analogous percentage was 31.5% in staphylococci other than *S. epidermidis* (Michalik et al., 2021).

The latest results highlight the role of the respiratory microbiota in the inflammation of the nasal cavity. According to the article published by Zawadzka-Głós, characteristic types of bacteria such as *Staphylococcus*, *Propionibacterium*, *Corynebacterium* and *Streptococcus* constitute part of the nasal mucosa microbiota in patients with chronic and allergic rhinosinusitis. Changes in the microbiome of the nasal cavity can be introduced by many factors: exposure to tobacco smoke or chronic use of antibiotics. Data presented in this article show that antibiotic therapy significantly alters the microbiota and that full recovery may take up to 6 months (Zawadzka-Głós, 2023).

Rovelsky et al. conducted a retrospective cohort study to compare the treatment of acute sinusitis with amoxicillin versus amoxicillin-clavulanate. A total of 89,627 patients diagnosed with acute sinusitis were included. The authors demonstrated that the rates of sinusitis-related return visits were nearly the same in both groups: 4.9% for patients treated with amoxicillin and 5.1% for those treated with amoxicillin-clavulanate ($P = 0.317$). Similar data were observed for infectious complications and hospitalizations, with no significant differences in both groups (Rovelsky, 2021).

Discussion

According to the EPOS 2020 guidelines, acute rhinosinusitis is a self-limiting condition and treatment should be primary symptomatic. Antibiotic therapy is recommended only in cases of acute rhinosinusitis that raise suspicion of bacterial origin (fever, unilateral disease, double sickening, elevated inflammatory markers). In the case of chronic rhinosinusitis there are no identified benefits from antibiotic therapy. Current guidelines recommend the use of intranasal or systemic corticosteroids and nasal rinsing. The new treatment options also include biologic therapy.

Despite these recommendations, the issue of antibiotic overuse in rhinosinusitis is still prevalent. Many studies from different countries show that antibiotics are prescribed more frequently than clinically indicated during infections of viral origin.

The overuse of antibiotics leads to the emergence of multidrug-resistant strains in patients with rhinosinusitis. The trend in antibiotic use in viral infections is a significant public health concern. Furthermore, some studies indicate that antibiotics modify nasal microbiota and the changes induced this way are long-lasting. The findings suggest that amoxicillin and amoxicillin-clavulanate demonstrate comparable effectiveness regarding infectious complications, hospitalizations and return visits.

The results discussed in this article emphasize the importance of judicious use of antibiotic therapy and are consistent with previously published studies concerning antibiotic overuse in viral rhinosinusitis. The consequences of this practice are significant and could affect individuals as well as the entire population. Therefore, proper education about potential threats among both patients, and physicians is urgently needed.

Conclusions

The trend of overusing antibiotics in rhinosinusitis of viral origin is prevalent and has been reported in many countries. Inappropriate antibiotic treatment is a major driver of increasing multidrug-resistance. Long-lasting dysbiosis of the nasal microbiota is another consequence of this practice. There are no significant differences in clinical effectiveness between amoxicillin and amoxicillin-clavulanate. More research is needed to investigate the reasons behind the overuse of antibiotics. It would be beneficial to construct transparent, evidence-based guidelines for the treatment of rhinosinusitis. Implementing educational programs for patients about threats of multidrug-resistant microbes could be effective.

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