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Dolna 17, Warsaw,
Poland 00-773
+48 226 0 227 03
editorial_office@rsglobal.pl

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CHRONIC UPPER RESPIRATORY CONDITIONS AND ATHLETIC PERFORMANCE: A SYSTEMATIC REVIEW OF RHINITIS, SINUSITIS, AND NASAL OBSTRUCTION IN PROFESSIONAL AND AMATEUR ATHLETES

Karolina Pasierb *(Corresponding Author, Email: k.pasierb36@gmail.com)*
The University Hospital in Krakow, Jakubowskiego 2, 30-668 Kraków, Poland
ORCID ID: 0009-0006-5806-3508

Aleksandra Piech
Clinical Provincial Hospital No. 2 in Rzeszów, Lwowska 60, 35-301 Rzeszów, Poland
ORCID ID: 0009-0001-4485-2200

Tomasz Ufniarski
University Clinical Centre in Gdańsk, Dębinki 7, 80-952 Gdańsk, Poland
ORCID ID: 0009-0008-6555-3403

Martyna Grodzińska
Lower Silesian Oncology, Pulmonology and Hematology Center, pl. Ludwika Hirszfelda 12, 53-413 Wrocław, Poland
ORCID ID: 0009-0004-1001-6484

Maria Ufniarska
Saint Adalbert Hospital in Gdańsk, aleja Jana Pawła II 50, 80-462 Gdańsk, Poland
ORCID ID: 0009-0008-5927-4811

Karol Poplicha
National Medical Institute of the Ministry of the Interior and Administration, Wołoska 137, 02-507 Warsaw, Poland
ORCID ID: 0009-0005-3835-9777

Justyna Moszkowicz
Clinical Provincial Hospital No. 2 in Rzeszów, Lwowska 60, 35-301 Rzeszów, Poland
ORCID ID: 0009-0009-2582-6187

Piotr Sobkiewicz
Lower Silesian Oncology, Pulmonology and Hematology Center, pl. Ludwika Hirszfelda 12, 53-413 Wrocław, Poland
ORCID ID: 0009-0007-6610-440X

Patrycja Kardasz
Saint Adalbert Hospital in Gdańsk, aleja Jana Pawła II 50, 80-462 Gdańsk, Poland
ORCID ID: 0009-0006-8137-9789

Bartłomiej Siuzdak
Clinical Provincial Hospital No. 2 in Rzeszów, Lwowska 60, 35-301 Rzeszów, Poland
ORCID ID: 0009-0003-8691-6617

Marta Jutrzenka
Praski Hospital in Warsaw, al. „Solidarności" 67, 03-401 Warsaw, Poland
ORCID ID: 0000-0001-7266-1586

Patrycja Ucieklak
District Hospital in Zawiercie, ul. Miodowa 14, 42-400 Zawiercie, Poland
ORCID ID: 0009-0002-3681-1051

ABSTRACT

Chronic upper respiratory conditions encompass a wide range of diseases including allergic rhinitis (AR), non-allergic rhinitis (NAR), and nasal polyps (NP) affecting a significant proportion of the general population, and posing a substantial burden on the healthcare system. Upper respiratory symptoms impair nasal airflow, worsen quality of life and negatively impact daily functioning and productivity. In both amateurs and professional athletes, nasal symptoms diminish athletic performance and competitive ability. Furthermore, such symptoms discourage recreational exercisers from regular physical activity, thereby undermining health status and increasing the risk of developing non-communicable diseases. According to the cited literature, athletes experience nasal symptoms more frequently than non-athletic individuals. This highlights a need for risk assessment, prevention strategies, accurate diagnostic tools, and individuated treatment. This review aims to evaluate the current state of knowledge regarding chronic upper respiratory conditions in athletes and explore their clinical impact. Further examination into pathophysiology, consequences, and optimal treatment strategies is necessary. Ultimately, creating robust, evidence-based guidelines for healthcare professionals regarding chronic upper respiratory conditions in athletes should be considered.

KEYWORDS

Rhinitis, Rhinosinusitis, Allergy, Chronic Nasal Obstruction, Exercise-Induced Rhinitis, Physical Activity

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Introduction

Impaired nasal airflow significantly worsens quality of life and negatively affects athletic performance (1–3). The nasal cavity, as the entry point of respiratory system, functions as the first line immune defense, as well as a heater, filter and humidifier. It is equipped with innate barrier (cilia, mucus and epithelium), immune cells (neutrophils, macrophages), and immunoglobulin, lysozyme and lactoferrin, which act synergistically to prevent microorganisms from entering the lower respiratory tract (1,2).

Any conditions causing nasal obstruction and disrupting the physiological role of nose may lead to mouth breathing, which has a detrimental effect on lower respiratory tract. Pollution, allergens, and microorganisms can deposit within the bronchial tree, while inspired cool, dry and unfiltered air. These factors impair respiratory tract functions, increase the risk of airway hyperresponsiveness, narrowing and asthma development (3).

Unfortunately, the exact impact of exercise on nasal discharge and its composition remains poorly understood(1). Citated studies have demonstrated a significant increase in nasal secretion volume during submaximal exercise, a phenomenon known as exercise-induced rhinorrhea, commonly referred to as athlets's nose(4). However, further examination into the volume and biochemical composition of nasal secretions are still insufficient.

Chronic upper respiratory diseases encompass a wide range of conditions, including chronic allergic rhinitis (AR) and non-allergic rhinitis (NAR), chronic rhinosinusitis (CRS), nasal polyps (NP) (5–7). There disorders reduce oxygen intake during physical activity and impair the sleep quality and duration, thereby negatively influencing cognitive function, and sports performance(8). According to the cited literature, athletes experience nasal symptoms more frequently than the non-athletic individuals(8,9).

Regular physical activity is a key protective factor against many non-communicable diseases and contributes to overall health maintenance. According to WHO guidelines, adults should engage in 150-300 minutes of moderate-intensity or 75 to 150 minutes of vigorous-intensity aerobic physical activity weekly(10). Chronic upper respiratory tract diseases not only impair athletic performance, crucial for professional athletes, but may also discourage amateurs athletes and recreational exercisers from regular training. Over time, this may result in decreased physical, mental well-being, as well as reduced quality of life.

Aims

The aims of this systematic review are the assessment and evaluation of the current state of knowledge concerning chronic allergic and non-allergic rhinitis, sinusitis, and nasal obstruction in athletes, and how the mentioned diseases affect physical prowess.

Materials and methods

A PubMed search was conducted for articles published between January 1987 to July 2025. Combination of MeSH and keywords, such as rhinitis, allergic and non-allergic rhinitis, rhinosinusitis, nasal polyps, chronic nasal obstruction, exercise, sports, athletic performance have been used. Refence lists of retrieved articles were also screened to capture additional relevant studies. Eligible publications included studies on athletes or recreationally active individuals addressing chronic upper airway disorders and reporting outcomes related to performance, exercise capacity, nasal airflow, or quality of life, while studies on acute infections, isolated lower airway diseases, or non-original reports were excluded. A total of 41 articles met the inclusion criteria and were incorporated in this review.

Chronic rhinitis, rhinosinusitis, and nasal polyps

Chronic rhinitis can be divided into allergic-induced rhinitis (AR), non-allergic rhinitis (NAR), and vasomotor rhinitis(11). NAR can be a differentiated subcategory of exercise-induced rhinitis (EIR), according to some articles, up to 50% of people suffer from some type of EIR, which can significantly impair nasal airflow, sports performance, because of paroxysmal sneezing, nasal congestion, and rhinorrhea(1,11–13). EIR can be divided in various ways, such as indoor or outdoor exercise-induced rhinitis, although EIR is numbered among NAR, it can also affect people with AR (12).

Athletes are more prone to develop rhinitis than the general population, most of the literature reports mostly allergic rhinitis prevalence and data concerning non-allergic rhinitis and chronic rhinosinusitis need more scientific attention (2,14–16).

Vasomotor rhinitis may be induced by cold, dry air, perfume, paint fumes, and cigarette smoke(13), and is characterized by great rhinorrhea and nasal congestion(12).

Allergic rhinitis (AR) is one of the most common diseases affecting people of all ages, affecting 10-25% of the population (3,6,15). AR is an inflammatory, Ig-E-mediated disease of the nasal mucosa, as an implication of exposure to inhaled allergens, which can be classified by frequency (seasonal, intermittent, or persistent) or by the intensity of symptoms (mild, moderate, or severe) (6). AR is characteristic of nasal itching and congestion, persistent sneezing, and rhinorrhea (3,7,12). Some studies showed athletes are a group at special risk of nasal obstruction secondary to rhinitis, which affects everyday life activities like sleep, ventilation, and wellbeing, and significantly hinders sports performance and the ability to compete (3).

Exercise-induced rhinitis (EIR) affects both groups NAR and AR, but individuals with nasal allergy more frequently report negative and adverse impacts of EIR on their athletic performance than individuals without allergy (12). EIR is potentially caused by various components, predominant parasympathetic reflex, epithelial injury, immunologic changes, and decreased mucociliary time(1,17). What is more, according to a cited study, exercising outdoors triggers rhinitis to a larger degree than exercising indoors, but interestingly individuals with nasal allergy experienced more EIR symptoms exercising indoors (12). Some athletes observe the improvement of rhinitis symptoms with regular training, but for some rhinitis symptoms are triggered by continuous exposure to allergens (mites indoor, pollens outside), inhalation of irritants (e.g.: ozone, chlorine derived from swimming pools), volatile weather conditions (cold or warm temperatures) (15). This is why observations of a higher prevalence of rhinitis are made in professional athletes in specific types of sports such as swimming, skiing, boxing, climbing, and running (1,3,14,15,18).

According to some studies, professional swimmers, swimming up to 30 hours per week, subjected to chlorine and hypochlorite liquid in floating air, certain temperatures, and pH levels, are susceptible to developing "chloride-treated water allergy" and are more prone to disorders such as rhinitis, rhinosinusitis, rhino-otitis (12,19).

"Skier's nose" is a condition characterized by rhinorrhea and nasal congestion after exposure to cold temperatures. Behind this condition not only parasympathetic reflex and dilatation of the nasal conchas, but also disturbed mucociliary transport time, and changed nasal resistance and nasal diameters (15,18).

Trauma, recurrent trauma, and permanent change to the nasal anatomy may lead to increased nasal resistance, alternation in rhinosinusal mucosa, and prolonged mucociliary transport time. All of those factors may result in recurrent and persistent rhinosinusal infections, anosmia, or hyposmia (15,18).

Chronic rhinosinusitis (CRS) is a group of chronic inflammation diseases of the mucosa of the nasal cavity and paranasal sinuses, characterized by mucosal edema, nasal polyps (NP), and purulent discharge seen during nasal endoscopy, mucosa thickening and opacification of sinuses in CT scans(5,6). Nasal polyps (NP) are lesions of nasal or perinasal mucosa, typically bilateral, caused by underlying conditions such as AR, NAR, or CRS, moreover in asthma, cystic fibrosis, or malignancy(3,6). Men are more prone to develop NP than women (23). CRS can be divided as primary or secondary, with further subclassification into localized or diffuse disease(20). Patients with allergic rhinitis are highly prone to developing sinusitis, some studies claim rhinitis and sinusitis coexist in 25-70% of patients(5,6,21,22). During the diagnostic process differentiation between non-allergic rhinitis and rhinosinusitis is often challenging and is possible in CT scans or nasal endoscopy(16). Patients with CRS experience nasal obstruction, facial pain and pressure, and reduction or loss of smell, which significantly affect patients' everyday life and quality of life(2,5), moreover regular physical activity may exacerbate symptoms. CRS is diagnosed when symptoms persist for more than 12 weeks (20,23).

Risk factors for developing primary chronic rhinosinusitis are tobacco smoke and occupational irritants. A subtype of CRS is a non-steroidal anti-inflammatory drug- (NSAID)-exacerbated respiratory disease, so-called aspirin insensitivity, the prevalence of this condition is 2-3% of the general population(16).

Secondary chronic rhinosinusitis is a progression of impairment of ciliary function, immune system dysfunction, and snoring, which slowly gravitate to obstructive sleep apnoea (OSA), which is frequently associated with nocturnal gastroesophageal reflux(16).

Diagnostic process

Proper and prompt diagnostic process plays a key role in implementing appropriate treatment and improving QoL and athletic performance. The first step is identifying symptoms-triggering factors (for example allergen, infectious microorganisms, low temperature, exercise itself, water, etc.) and physical examination(2,15). Case history taking should obtain detailed information on nasal symptoms and general medical history(16).

There are many validated questionnaires supporting the diagnosis process concerning screening for nasal conditions, e.g.: the Nasal Obstruction Symptom Evaluation (NOSE) scale(24), the Sino-Nasal Outcome Test (SNOT)(25), and the SNOT22(26). Only one validated questionnaire concern athletes and allergic rhinitis- AQUA (8,16). Although the NOSE scale may be useful in screening for nasal obstruction in athletes(16).

Anterior rhinoscopy is the easiest and most accessible way of assessing nasal mucosa, inferior concha, and nasal septum deviation. If nasal endoscopy is available, a more detailed assessment of the nasal cavity could be considered. Physical examination if needed, can be supported by a computed tomography scan of the facial area (2).

If nasal obstruction is one of the presenting symptoms, nasal patency could be evaluated by rhinomanometry, peak nasal inspiratory flow (PNIF) measurements, and acoustic rhinometry(16,27).

Athletes who present with any airway symptoms should be checked for allergy, beginning with family history, and then a suitable allergy test ought to be performed(27). In some instances, a test for nasal hyperreactivity (NHS) should be considered. In the cited article authors proposed also performing an exercise challenge test to measure nasal obstruction and/or evaluation of nasal secreting before and after exercise(2,28).

Treatment

Treatment should improve nasal symptoms and prevent the development and progression of any exercise-induced symptoms. Some obstacles concerning treatment are noticed in professional athletes, not only do medical professionals have to help the patients, but also comply with World Anti-Doping Agency (WADA) regulations(2,8).

First, sometimes underestimated way of treatment is, if possible, avoidance of triggers(29). Nasal saline rinse, before topical nasal sprays, should be recommended for athletes with allergic rhinitis during the allergic season(16,29,30), and do not interfere with WADA regulations.

Unfortunately in many cases avoidance of triggers is impossible, controlling nasal symptoms only with nasal saline douche is not achievable. This is why pharmacological treatment is so crucial for the well-being and adequate quality of patients' lives.

Antihistamines bind histamine receptors, preventing symptoms like sneezing, pruritus, and rhinorrhea. First-generation antihistamines exhibit more sedative and worsening sleep effects (31), second and third generation is recommended to patients with mentioned symptoms(1,3). Antihistamines are a first-choice treatment for athletes with allergic rhinitis. Moreover, this drug group is permitted for use by WADA's Regulations(1).

Intranasal corticosteroids (INS), such as beclomethasone and fluticasone, are the most effective drugs for treating allergic rhinitis and chronic nasal congestion, moreover, reduce the risk of bronchial hyperresponsiveness and asthma attacks(3,32). An important advantage of intranasal corticosteroids is deposition locally in the nasal cavity, without deposition effect in lower airways(32). One week of using intranasal budesonide reduces the symptoms of EIR in

athletes(33). The side effects of INS are minor epistaxis, crusting, nasal dryness, and irritation of the throat and nose, but rarely it is a reason to end INS therapy(8). INS are permitted by WADA.

Oral corticosteroids (OS) are indicated in uncontrolled AR with severe symptoms not responding to any other medications. WADA permits OS under a therapeutic use exemption (TUE) rule(8).

Decongestants are particularly beneficial during the common cold, as a short-term treatment of up to 7 days. Professional athletes should be cautious and consult every decongestant with annually changing WADA's Regulations, as many decongestants are available as OTC medications. Additionally, decongestants are not suitable for treating AR, NAR, and CSR and pose a great risk of causing rhinitis medicamentosa, a decongestant-induced paradoxical swelling of the nasal mucosa(8).

Mast cell stabilizers or cromoglycates can be used intranasally and treat mild to moderate nasal symptoms such as itch, rhinorrhea, and sneezing, but are less effective than antihistamines. Mast cell stabilizers are allowed by WADA(8,34).

Antileukotrienes or leukotriene receptor agonists have shown similar efficacy as antihistamines but without sedative effect(34). Antileukotrienes are allowed by WADA (8).

Immunotherapy is a therapeutic option when regular treatment does not solve symptoms of allergic rhinitis and it is only disease modifying treatment. There are available sublingual (SLIT) or subcutaneous (SCIT) options(16,30). Immunotherapy helps reduce medication and minimize symptoms of AR, leading to long-term disease control (35). SLIT and SCIT are permitted by WADA(8).

In case of dynamic or structural nasal obstruction, pharmacological treatment might not be effective. Internal or external dilating devices are interim option when needed during training, contests, or even sleep(36–38). Surgery is often the only permanent option, which has to be considered in terms of quality of life and for athletes' sports performance and competition(16,39,40). There are different types of dilating devices and techniques of surgery, suited for different types of nasal obstruction, but a detailed discussion of these is beyond the scope of this review.

Based on presented disease entities, diagnostic guidelines, and treatment options it is clear every case could be different, and require an individual approach. Cited studies have suggested the concept of precision-based medicine of 4P's: prediction, prevention, personalization, and participation(8,41). Prediction is understood as identifying a group of patients being at risk of developing upper respiratory symptoms, as well as education what it exactly means and when to contact a healthcare provider. Early interference helps identify the problem and may reduce exposure and symptoms. Then personalization of diagnosis and treatment is critical, what is more, medical professionals have to take into consideration every aspect of patients' lives and discuss it with them. Elite athletes and doctors must be updated with the newest WADA's Regulations and respect them. Last but not least, patients have to know all side effects, and limitations and accept them to comply with the planned treatment plan, participation of both patient and medic is undeniably vital for therapy outcomes.

Conclusions

Chronic upper respiratory conditions are still a great and frequent issue, although more accessible and accurate diagnostic tools and treatments, with massive impact on amateurs' and professional athletes' performance. Diagnostic, prevention, and treatment processes need further improvement, moreover creating robust guidelines for medical professionals should be the ultimate aim. There is a great need for more investigation into whether intensive exercise regularly is a risk factor for and is associated with rhinitis and rhinosinusitis.

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Author's contribution:
Conceptualization, Karolina Pasierb, and Aleksandra Piech;
Methodology, Karolina Pasierb, Karol Poplicha;
Software, Tomasz Ufniarski, Justyna Moszkowicz, Patrycja Ucieklak;
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Formal analysis, Bartłomiej Siuzdak, Marta Jutrzenka, Martyna Grodzińska;
Writing - rough preparation, Karolina Pasierb, Aleksandra Piech, Karol Poplicha, Patrycja Kadasz;
Writing - review and editing, Karolina Pasierb, Maria Kleczkowska, Bartłomiej Siuzdak, Aleksandra Piech, Piotr Sobkiewicz, Patrycja Ucieklak;
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REFERENCES

1. Walker A, Surda P, Rossiter M, Little S. Nasal function and dysfunction in exercise. J Laryngol Otol. maj 2016;130(5):431–4.
2. Steelant B, Hox V, Hellings PW, Bullens DM, Seys SF. Exercise and Sinonasal Disease. Immunol Allergy Clin North Am. maj 2018;38(2):259–69.
3. Fisher LH, Davies MJ, Craig TJ. Nasal obstruction, the airway, and the athlete. Clin Rev Allergy Immunol. październik 2005;29(2):151–8.
4. Stanford CF, Stanford RL. Exercise induced rhinorrhoea (athlete's nose). BMJ. 10 wrzesień 1988;297(6649):660.
5. Fokkens WJ, Lund VJ, Hopkins C, Hellings PW, Kern R, Reitsma S, i in. Executive summary of EPOS 2020 including integrated care pathways. Rhinology. 1 kwiecień 2020;58(2):82–111.
6. Iordache A, Balica NC, Horhat ID, Morar R, Tischer AA, Milcu AI, i in. Allergic rhinitis associated with nasal polyps and rhinosinusitis - histopathological and immunohistochemical study. Romanian J Morphol Embryol Rev Roum Morphol Embryol. 2022;63(2):413–9.
7. Seidman MD, Gurgel RK, Lin SY, Schwartz SR, Baroody FM, Bonner JR, i in. Clinical practice guideline: Allergic rhinitis. Otolaryngol--Head Neck Surg Off J Am Acad Otolaryngol-Head Neck Surg. luty 2015;152(1 Suppl):S1-43.
8. Hox V, Beyaert S, Bullens D, Couto M, Langer D, Hellings PW, i in. Tackling nasal symptoms in athletes: Moving towards personalized medicine. Allergy. wrzesień 2021;76(9):2716–29.
9. Walker AC, Surda P, Rossiter M, Little SA. Nasal disease and quality of life in athletes. J Laryngol Otol. wrzesień 2018;132(9):812–5.
10. Bull FC, Al-Ansari SS, Biddle S, Borodulin K, Buman MP, Cardon G, i in. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. Br J Sports Med. grudzień 2020;54(24):1451–62.
11. Khalid H, Tait JE, North AS, Lakhani R. The Practical Management of Rhinitis in Athletes. Clin J Sport Med Off J Can Acad Sport Med. 30 lipiec 2024;
12. Silvers WS, Poole JA. Exercise-induced rhinitis: a common disorder that adversely affects allergic and nonallergic athletes. Ann Allergy Asthma Immunol Off Publ Am Coll Allergy Asthma Immunol. luty 2006;96(2):334–40.
13. Dykewicz MS, Fineman S, Skoner DP, Nicklas R, Lee R, Blessing-Moore J, i in. Diagnosis and management of rhinitis: complete guidelines of the Joint Task Force on Practice Parameters in Allergy, Asthma and Immunology. American Academy of Allergy, Asthma, and Immunology. Ann Allergy Asthma Immunol Off Publ Am Coll Allergy Asthma Immunol. listopad 1998;81(5 Pt 2):478–518.
14. Bonini S, Bonini M, Bousquet J, Brusasco V, Canonica GW, Carlsen KH, i in. Rhinitis and asthma in athletes: an ARIA document in collaboration with GA2LEN. Allergy. 2006;61(6):681–92.
15. Spence L, Brown WJ, Pyne DB, Nissen MD, Sloots TP, Mccormack JG, i in. Incidence, Etiology, and Symptomatology of Upper Respiratory Illness in Elite Athletes. Med Sci Sports Exerc. kwiecień 2007;39(4):577.

16. McIntosh C, Clemm HH, Sewry N, Hrubos-Strøm H, Schwellnus MP. Diagnosis and management of nasal obstruction in the athlete. A narrative review by subgroup B of the IOC Consensus Group on „Acute Respiratory Illness in the Athlete". J Sports Med Phys Fitness. sierpień 2021;61(8):1144–58.
17. Bougault V, Turmel J, St-Laurent J, Bertrand M, Boulet LP. Asthma, airway inflammation and epithelial damage in swimmers and cold-air athletes. Eur Respir J. 31 marzec 2009;33(4):740–6.
18. Passàli D, Damiani V, Passàli GC, Passàli FM, Bellussi L. Alterations in rhinosinusal homeostasis in a sportive population: our experience with 106 athletes. Eur Arch Oto-Rhino-Laryngol Off J Eur Fed Oto-Rhino-Laryngol Soc EUFOS Affil Ger Soc Oto-Rhino-Laryngol - Head Neck Surg. październik 2004;261(9):502–6.
19. Bougault V, Turmel J, Levesque B, Boulet LP. The respiratory health of swimmers. Sports Med Auckl NZ. 2009;39(4):295–312.
20. Fokkens WJ, Lund VJ, Hopkins C, Hellings PW, Kern R, Reitsma S, i in. European Position Paper on Rhinosinusitis and Nasal Polyps 2020. Rhinology. 20 luty 2020;58(Suppl S29):1–464.
21. Feng CH, Miller MD, Simon RA. The united allergic airway: connections between allergic rhinitis, asthma, and chronic sinusitis. Am J Rhinol Allergy. 2012;26(3):187–90.
22. Baroody FM, Mucha SM, Detineo M, Naclerio RM. Nasal challenge with allergen leads to maxillary sinus inflammation. J Allergy Clin Immunol. maj 2008;121(5):1126-1132.e7.
23. Stevens WW, Schleimer RP, Kern RC. Chronic Rhinosinusitis with Nasal Polyps. J Allergy Clin Immunol Pract. 2016;4(4):565–72.
24. Stewart MG, Witsell DL, Smith TL, Weaver EM, Yueh B, Hannley MT. Development and validation of the Nasal Obstruction Symptom Evaluation (NOSE) scale. Otolaryngol--Head Neck Surg Off J Am Acad Otolaryngol-Head Neck Surg. luty 2004;130(2):157–63.
25. Piccirillo JF, Merritt MG, Richards ML. Psychometric and clinimetric validity of the 20-Item Sino-Nasal Outcome Test (SNOT-20). Otolaryngol--Head Neck Surg Off J Am Acad Otolaryngol-Head Neck Surg. styczeń 2002;126(1):41–7.
26. Hopkins C, Gillett S, Slack R, Lund VJ, Browne JP. Psychometric validity of the 22-item Sinonasal Outcome Test. Clin Otolaryngol Off J ENT-UK Off J Neth Soc Oto-Rhino-Laryngol Cervico-Facial Surg. październik 2009;34(5):447–54.
27. Hellings PW, Scadding G, Alobid I, Bachert C, Fokkens WJ, Gerth van Wijk R, i in. Executive summary of European Task Force document on diagnostic tools in rhinology. Rhinology. 1 grudzień 2012;50(4):339–52.
28. Van Gerven L, Boeckxstaens G, Jorissen M, Fokkens W, Hellings PW. Short-time cold dry air exposure: A useful diagnostic tool for nasal hyperresponsiveness. The Laryngoscope. 2012;122(12):2615–20.
29. Wheatley LM, Togias A. Clinical practice. Allergic rhinitis. N Engl J Med. 29 styczeń 2015;372(5):456–63.
30. Bousquet J, Schünemann HJ, Togias A, Bachert C, Erhola M, Hellings PW, i in. Next-generation Allergic Rhinitis and Its Impact on Asthma (ARIA) guidelines for allergic rhinitis based on Grading of Recommendations Assessment, Development and Evaluation (GRADE) and real-world evidence. J Allergy Clin Immunol. styczeń 2020;145(1):70-80.e3.
31. Passalacqua G, Bousquet J, Bachert C, Church MK, Bindsley-Jensen C, Nagy L, i in. The clinical safety of H1-receptor antagonists. An EAACI position paper. Allergy. październik 1996;51(10):666–75.
32. Corren J. Allergic rhinitis and asthma: how important is the link? J Allergy Clin Immunol. luty 1997;99(2):S781-786.
33. Helenius I, Haahtela T. Allergy and asthma in elite summer sport athletes. J Allergy Clin Immunol. wrzesień 2000;106(3):444–52.
34. Bousquet J, Khaltaev N, Cruz AA, Denburg J, Fokkens WJ, Togias A, i in. Allergic Rhinitis and its Impact on Asthma (ARIA) 2008 update (in collaboration with the World Health Organization, GA(2)LEN and AllerGen). Allergy. kwiecień 2008;63 Suppl 86:8–160.
35. Roberts G, Pfaar O, Akdis CA, Ansotegui IJ, Durham SR, Gerth van Wijk R, i in. EAACI Guidelines on Allergen Immunotherapy: Allergic rhinoconjunctivitis. Allergy. kwiecień 2018;73(4):765–98.
36. Rr D, Cr de A, C IC. External nasal dilators: definition, background, and current uses. Int J Gen Med [Internet]. 11 listopad 2014 [cytowane 23 czerwiec 2025];7. Dostępne na: https://pubmed.ncbi.nlm.nih.gov/25419156/
37. Matteo G, Giuseppe P, Domenico A, Vitaliano NQ, Nicola Q, Giorgio C. The role of an internal nasal dilator in athletes. Acta Bio Medica Atenei Parm. 2019;90(Suppl 2):28–30.
38. Valsamidis K, Printza A, Valsamidis N, Constantinidis J, Triaridis S. Improvement of the aerobic performance in endurance athletes presenting nasal valve compromise with the application of an internal nasal dilator. Am J Otolaryngol. 2024;45(1):104059.
39. Kasperbauer JL, Kern EB. Nasal valve physiology. Implications in nasal surgery. Otolaryngol Clin North Am. listopad 1987;20(4):699–719.
40. Fischer H, Gubisch W. Nasal valves--importance and surgical procedures. Facial Plast Surg FPS. listopad 2006;22(4):266–80.
41. Hellings PW, Fokkens WJ, Bachert C, Akdis CA, Bieber T, Agache I, i in. Positioning the principles of precision medicine in care pathways for allergic rhinitis and chronic rhinosinusitis - A EUFOREA-ARIA-EPOS-AIRWAYS ICP statement. Allergy. wrzesień 2017;72(9):1297–305.