sciendo

DOI: 10.2478/rjr-2024-0016

Romanian Journal of Rhinology, Volume 14, No. 55, July - September 2024

EDITORIAL

The present and future in rhinology

Prof. Dr. Codrut Sarafoleanu[1,2]

[1]"Carol Davila" University of Medicine and Pharmacy, Bucharest, Romania

[2]ENT&HNS Department, CESITO Center, "Sfanta Maria" Hospital, Bucharest, Romania

In the medical field, **artificial intelligence** has spread quite quickly, fulfilling complex functions in a very short time. Useful systems have been developed for both diagnosis and treatment planning, increasing therapeutic efficiency and disease prognosis. Artificial intelligence, digitization, advanced imaging techniques and small-sized cameras are innovative additions that have transformed rhinology and improved patient care options.

The remarkable shift from simple physical examinations to more detailed visual examinations has been due to the advent of small-sized cameras, endoscopes with microsensors, and advanced imaging techniques such as 3D surface imaging. With the help of these technologies, clinicians should have a clearer view of the nasal cavity. These advances enable non-invasive, precise and detailed examinations, improving the efficiency and accuracy of diagnosis and allowing for more comprehensive preoperative surgical planning. All these technological advances not only improve examination techniques, but also reshape our understanding of human nasal anatomy.

With the introduction of telemedicine, remote consultations have become more widespread, and smartphone and digital videos have allowed rhinologists to extend their reach to patients worldwide. The integration of telemedicine has made rhinology services much more accessible, providing timely diagnosis and medical care, thus facilitating early diagnosis[1].

An interesting fusion of technology and medical procedures is the introduction of virtual reality and augmented reality in surgical preparation. Remote augmented reality, such as Helping Hands, is an innovation that supports skill development and oversees the acquisition of surgical skills through distance learning during clinical practice[2]. Currently, surgeons in training can practice complex surgical procedures such as functional rhinoplasty, piezoelectric rhinoplasty or osteotomy before entering the operating room. These technologies provide trainees with an immersive and risk-free simulation, enhancing their skills and efficiency, reducing the likelihood of errors and improving patient safety. From planning surgical steps to execution, virtual reality and augmented reality have enriched the learning environment, benefiting not only surgeons but also patients.

Artificial intelligence and machine learning algorithms have revolutionized decision-making in rhinology. This power to analyze complex data, understand diverse patterns, and interpret high-quality data for predictive implications has the effect of improving diagnostic accuracy and personalizing patient care based on individual medical criteria. Automated analysis can predict treatment benefits.

Rhinology is a **dynamic field** in continuous evolution, which is why there is a need for the periodic publication of new specialty guidelines that encompass new concepts of etiology, diagnostic methods, and treatment strategies.

A deeper understanding of the etiologies and physiopathological mechanisms involved in the development of rhinosinusitis has led to the emergence of classifications based on the causes and pathogenic mechanisms of this pathology, thus paving the way for new, more specific therapeutic approaches.

Corresponding author: Prof. Dr. Codrut Sarafoleanu, ENT&HNS Department, CESITO Center, "Sfanta Maria" Hospital, 37-39 Ion Mihalache Blvd., District 1, Bucharest, Romania

ORCID: https://orcid.org/0000-0002-9436-7772

e-mail: csarafoleanu@gmail.com

Received for publication: June 3, 2024 / **Accepted:** June 14, 2024

Numerous pathologies, such as those of odontogenic cause, fungus ball, rhinosinusal tumors, can be determining causes of unilateral chronic rhinosinusitis, while cystic fibrosis, eosinophilic granulomatosis with polyangiitis (EGPA), granulomatosis with polyangiitis (formerly called Wegener's granulomatosis) or primary ciliary dyskinesia can lead to bilateral chronic rhinosinusitis. Therefore, it was necessary to introduce the terms primary and secondary chronic rhinosinusitis in the EPOS2020 guide (European Position Paper on Rhinosinusitis)[3,4].

The phenotypic classification of chronic rhinosinusitis has been abandoned in favour of an inflammatory endotype classification, based on physiopathological mechanisms.

The therapeutic scenario of chronic rhinosinusitis has changed since the introduction of monoclonal antibody therapy. In the near future, we will not only choose the best biological treatment for chronic rhinosinusitis with nasal polyps, but also select the optimal biological treatment for each individual patient. It is important to consider the individualization of treatment for each patient, as we do not have a treatment that suits everyone. The therapeutic approach is evolving from intranasal corticosteroid and surgical treatment to biological therapy/surgical treatment. The goal of treatment is shifting from symptom relief to long-term effects aimed at symptom remission. Regarding surgical treatment, it does not cure rhinosinusitis, but has good results, with benefits on both the upper and lower respiratory tracts.

With the advent of biological treatment, symptom remission has been observed. Biological treatment represents a new, effective treatment modality in chronic polypoid rhinosinusitis endotype II, targeting the treatment of the cause rather than the symptoms. This treatment can be associated with surgical treatment or with a short course of corticosteroids.

In approximately 80% of cases, type II inflammatory cytokines such as Interleukin 4, Interleukin 5, Interleukin 13 have been found in the mucosal tissues of patients with chronic rhinosinusitis with nasal polyps[5]. Biological treatment has proven to have favourable outcomes and no adverse effects have been reported. However, this treatment is currently very expensive.

Mobile health technology applications have great potential in improving patient compliance through education and self-management.

Uncontrolled chronic rhinosinusitis can be associated with factors dependent on the patient, the disease, diagnosis and treatment. Active patient participation in the management of chronic rhinosinusitis has been observed to improve treatment compliance, leading to a reduction in cases of uncontrolled disease.

Recently, multiple mobile applications for rhinosinusitis conditions have emerged, but none were developed in collaboration with medical experts in rhinosinusitis. The application "mySinusitisCoach" was developed in collaboration with rhinology experts from EUFOREA (European Forum for Research and Education in Allergy and Airways Diseases)[6]. This program involves the active participation of patients in the care of chronic rhinosinusitis. It has been registered as a class I medical device and is based on the visual analogue scale for monitoring patients with chronic rhinosinusitis. Using this application, improved disease control and treatment response have been observed[3].

MASK-Rhinitis (MASK - Mobile Airways Sentinel Network) is an application that allows patients with allergic rhinitis to monitor their ocular, nasal, or pulmonary symptoms and then discuss them with their healthcare provider. It also assesses patients' productivity at work[7].

Global Chronic Rhinosinusitis with Nasal Polyps Awareness Day was organized for the first time in 2022, when EUFOREA aimed to draw attention to chronic rhinosinusitis, considering this disease to be underestimated[8]. Through this project, EUFOREA aims to educate both healthcare professionals and patients about chronic rhinosinusitis with nasal polyps and its associated comorbidities, as well as to draw attention to the impact this pathology has on the quality of mental and physical health of these patients. This year, Global Chronic Rhinosinusitis with Nasal Polyps Awareness Day was organized on April 24th aiming for the active involvement of patients in managing their disease. The objectives of this edition included: a practical guide to assist patients with appointments with their healthcare providers; improving the accessibility of information about chronic rhinosinusitis with nasal polyps and its associated comorbidities; opportunities to promote awareness of this pathology and its recognition by government organizations responsible for legislation[8,9].

Nowadays, **endoscopic sinus surgery** is so common in everyday clinical practice that it is almost unimaginable how it was like in the past without it. Functional endoscopic sinus surgery (FESS) was initially a therapeutic principle only for chronic rhinosinusitis. Over time, endoscopic surgery has evolved from sinus surgery to skull base surgery. There is potential for improvement in endoscopic surgery for nasal and sinus tumors, tumors of the skull base and surrounding areas through complementary techniques that include, among others: surgical instruments, imaging, implants, artificial intelligence and robotics. Throughout the years, numerous discoveries have been made, and we cur-

rently have multiple visualization tools and computer-aided navigation. Additionally, imaging of the brain, neurovascular structures and 3D endoscopy allow for the visualization of anatomical structures associated with tissue impregnation using contrast agents or fluorescein to differentiate healthy tissue from pathological tissue.

Skull base surgery has evolved over the years with the advent of implants that allow for the recovery of brain function, reduce the occurrence of postoperative cerebrospinal fluid fistulas, and thus significantly diminish the comorbidities that can be associated with an extensive approach[10].

Using 3D printing, reconstructions can be performed that are very useful in planning the surgical approach. New technologies can be useful in creating simulators for practicing techniques in sinus surgery or skull base surgery.

We wonder what will happen in the future in rhinology, will there be radical changes or will everything be destroyed?

Currently, there is a revolution in understanding chronic inflammatory diseases in rhinology. To understand the underlying process in chronic rhinosinusitis, we are talking about multiple diseases with similar presenting symptoms.

Precision medicine uses biomarkers or various tests that predict treatment response. Piezoelectric ultrasonic rhinoplasty facilitates more precise osteotomies and sculpting of nasal and maxillary bones, preventing soft tissue destruction. The precision achievable with piezoelectric technology is difficult to attain even with a fine drill[11,12].

It has been noted that robotic surgery is already changing the management of head and neck pathology. Currently, transoral robotic surgery is used in clinical practice, most commonly applied to oncological pathology of the oropharynx, followed by the hypopharynx, larynx, oral cavity and salivary glands[13,14]. Presently, these devices are too bulky for widespread use in rhinology, but skull base surgery is gaining ground, with new efficient robotic instruments described for the endoscopic endonasal approach to the skull base[15,16].

We are not far from being able to analyze proteins synthesized in each tumor cell. This fact will allow chemotherapy to act in a targeted manner. Imagine the possibility of culturing cells from a biopsy and testing multiple therapeutic strategies (similar to current practices in microbiology), exposing the patient's own cell cultures in organoids to simultaneously assess the effect of these treatments on the host.

In the coming years, other innovations will continue to emerge that will seem natural to our descendants, but extraordinary to us. For example, Richard Feynman, in his work "There's Plenty of Room at the Bottom" presented at the 1959 annual meeting of the American Physical Society and detailed later in the book "Feynman and Computation" in 2002, proposed to the audience to imagine a microscopic surgeon operating at the molecular level[17,18].

The time will come when nanoscale sensors will create high-resolution cellular maps with the capability of simultaneous computerized simulation of target physiology, allowing multiple *in vitro* simulations of the therapeutic response. We can envision a real-time computer simulation of the forces involved in the healing process of the nose after a septorhinoplasty, anticipating the outcomes of each precise suture placement and tension, the localization and angulation of each incision.

Advanced chess (centaur chess) has already become the most powerful form of the game (combining human strategy and machine computation to explore the potential outcomes of each possible move). The human part of the centaur may not even be in the same geographic location as the patient. It is unlikely for the human part of the centaur to sit in front of a screen. The power of these approaches is very likely to be channelled through virtual and augmented reality display technologies. Augmented reality, by overlaying visual information onto the real world, can provide additional senses by detecting wavelengths and ultrasounds outside the human visual spectrum.

In conclusion, as long as we have human patients, the human side of the centaur will always have a place in medicine. The physician's ultimate role is to be a human connection for the patient in a world that exceeds their capacity for understanding.

Financial disclosure: There are no financial disclosures of the author.

Conflict of interest: The author has no conflict of interest.

Funding: None.

REFERENCES

1. Hentati F, Cabrera CI, D'Anza B, Rodriguez K. Patient satisfaction with telemedicine in rhinology during the COVID-19 pandemic. Am J Otolaryngol. 2021;42(3):102921. DOI: 10.1016/j.amjoto.2021.102921.
2. Mather C, Barnett T, Broucek V, Saunders A, Grattidge D, Huang W. Helping Hands: Using augmented reality to provide remote guidance to health professionals. Stud Health Technol Inform. 2017;241:57-62.
3. Fokkens W, Desrosiers M, Harvey R, Hopkins C, Mullol J, Philpott C, et al. EPOS2020: development strategy and goals for the latest European Position Paper on Rhinosinusitis. Rhinology. 2019;57(3):162-8. DOI: 10.4193/Rhin19.080.
4. Grayson JW, Hopkins C, Mori E, Senior B, Harvey RJ. Contemporary classification of chronic rhinosinusitis beyond polyps vs no polyps: A re-

view. JAMA Otolaryngol Head Neck Surg. 2020;146(9):831-8. DOI: 10.1001/jamaoto.2020.1453.
5. Cardell LO, Stjarne P, Jonstam K, Bachert C. Endotypes of chronic rhinosinusitis: Impact on management. J Allergy Clin Immunol. 2020;145(3):752-6. DOI: 10.1016/j.jaci.2020.01.019.
6. Seys SF, Bousaquet J, Bachert C, Fokkens WJ, Agache I, Bernal-Sprekelsen M, et al. mySinusCoach: patient empowerment in chronic rhinosinusitis using mobile technology. Rhinology. 2018;56(3):209-15. DOI: 10.4193/Rhin17.253.
7. Larenas-Linnemann D, Mullol J, Ivancevich JC, Anto JM, Cardona V, Dedeu T, et al. MASK (Mobile Airways Sentinel Network), a mobile App with ARIA's comprehensive solution in Spanish-speaking countries. Rev Alerg Mex. 2019;66(2):263-8. DOI: 10.29262/ram.v66i2.628.
8. Fokkens WJ. Global CRSwNP Awareness Day and the European Society meeting in Sofia. Rhinology. 2023;61(3):193. DOI: 10.4193/Rhin23-903.
9. European Forum for Research and Education in Allergy and Airway Diseases. 2024 Global CRSwNP Awareness Day. [Internet]. Available from: https://www.euforea.eu/events/2024-global-crswnp-awareness-day.
10. Nizamis K, Athanasiou A, Almpani S, Dimitrousis C, Astaras A. Converging robotic technologies in targeted neural rehabilitation: A review of emerging solutions and challenges. Sensors (Basel). 2021;21(6):2084. DOI: 10.3390/s21062084.
11. Hashemi S, Noel CW, Smith OD. Comparing the piezoelectric and conventional osteotome in rhinoplasty. Am J Otolaryngol. 2023;44(2) :103759. DOI: 10.1016/j.amjoto.2022.103759.
12. Tsikopoulos A, Tsikopoulos K, Doxani C, Vagdatli E, Meroni G, Skoulakis C, et al. Piezoelectric or conventional osteotomy in rhinoplasty? A systematic review and meta-analysis of clinical outcomes. ORL J Otorhinolaryngol Relat Spec. 2020;82(4):216-34. DOI: 10.1159/000506707.
13. Riva G, Cravero E, Briguglio M, Capaccio P, Pecorari G. The flex robotic system in head and neck surgery: A review. Cancers (Basel). 2022;14(22):5541. DOI: 10.3390/cancers14225541.
14. Kalantari F, Rajaeih S, Daneshvar A, Karbasi Z, Salem MM. Robotic surgery of head and neck cancers, a narrative review. Eur J Transl Myol. 2020;30(2):8727. DOI: 10.4081/ejtm.2019.8727.
15. Pangal DJ, Cote DJ, Ruzevick J, Yarovinsky B, Kugener G, Wrobel B, et al. Robotic and robot-assisted skull base neurosurgery: systematic review of current applications and future directions. Neurosurg Focus. 2022;52(1):E15. DOI: 10.3171/2021.10.FOCUS21505.
16. Dimitrakakis E, Aylmore H, Lindenroth L, Dwyer G, Carmichael J, Khan DZ, et al. Robotic handle prototypes for endoscopic endonasal skull base surgery: pre-clinical randomised controlled trial of performance and ergonomics. Ann Biomed Eng. 2022;50(5):549-63. DOI: 10.1007/s10439-022-02942-z.
17. Feynman RP. There's plenty of room at the bottom. Engineering and Science. 1960;23(5):22-36.
18. Feynman R. There's plenty of room at the bottom. In: Hey A. Feynman and Computation. 1st Edition. CRC Press, Boca Raton, FL; 2002, p. 48-57.