Otorhinolaryngology and Artificial Intelligence

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Artificial intelligence (AI) is a set of data-oriented techniques and algorithms that are arranged to make predictions or deductions from new data in light of past data. The term AI was coined by John McCarthy as “the science and engineering of developing intelligent computer programs”. Since AI is also a collection of various technologies aimed at automating human intellectual processes, different AI technologies are designed for different practices (1). These technologies are reckoned to significantly reduce the need for human labor power in many fields in the near future.

Artificial intelligence is seen to increasingly remain at the forefront of academic research and popular culture discussions. A search was conducted in the PubMed database in June 2019 for the term “artificial intelligence” in order to identify the usage of AI techniques in the medical literature and this search returned 88,727 articles. The number of articles on AI were seen to have increased almost twofold from the previous year.

The application of AI techniques in medicine is relatively new. The purpose of AI in medicine is not to replace the physician, but rather to provide them with advice and recommendations based on the patient data. In the near future, especially the evaluation of the surgical anatomy and anomalies in radiological sections, fast analysis of intraoperative surgical specimens or fine needle aspiration biopsy samples will be possible with the help of AI algorithms (1, 2).

While the use of AI seems to be a revolutionary event in the provision of healthcare services, today, its use in the field of otorhinolaryngology, both in practice and in patient care, is limited. Otorhinolaryngologists are key stakeholders in the development and clinical integration of AI technologies. Therefore, collecting high-quality data about patients and diseases is essential for the advancement of AI technologies (3). The first examples of machine learning, a subset of AI, in otorhinolaryngology are used for the automatic recognition of auditory brainstem response waveforms, and the classification of acoustic sound features (4, 5).

Malignancies of the head and neck are the most common cases in which AI technologies are used in otorhinolaryngology. AI has been used alongside hyperspectral imaging for differentiating between normal head and neck tissue and thyroid malignancies, and is reported to function with 97% sensitivity, 96% specificity, and 96% accuracy. The system is said to enable surgeons to more precisely define resection margins during procedures (6). Moreover, clinicopathological and genomic markers have been integrated into this system, and successful results have been obtained in predicting the prognosis of cancer patients. Another promising application of AI is automatic radiotherapy planning. Three-dimensional tumor volumes, especially, can be computed and dosing can be planned more realistically.

Similarly, AI technologies are used in determining the prognosis of sudden sensorineural hearing
losses in otology, in the imaging of endolymphatic hydrops, and
in identifying the phenotypes of hearing loss (7). In laryngology,
T1a glottic cancers and other pathologies of the vocal cord can
be diagnosed with almost 100% accuracy when AI programs
are used together with voice analysis and videostroboscopy im-
ages (8). While the use of AI in rhinology is limited, studies in
paranasal sinuses, diagnosis of sinusitis and detection of sinus
pathologies are continuing (9).

Although AI applications stand to reduce the need for physi-
cians in the laboratory branches of medicine in the near future,
this development may not be as rapid in the clinical and the
surgical branches. Nevertheless, it is clear that using AI will pro-
vide substantial guidance to physicians in challenging decisions,
complex diagnoses and treatments.

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