LETTER TO EDITOR

A.I. in RadioProtection of Salivary Glands in Head and Neck Cancer Patients: Quantum Computing and Machine Learning

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The GLOBOCAN 2020 (Global Cancer Statistics 2020) estimated that there were 19.3 million new cases of cancer and almost 10 million deaths from cancer in 2020[1]. Annually, head and neck cancer (H.N.C.) affect approximately 880.000 new patients, World-wide. Indeed, squamous cell carcinoma represents a leading cause of morbidity and mortality and therefore, a burden, in many nations, irrespective of the regional development level1. Globally, the 5-year overall H.N.C. survival is 50%–65%, estimated for cases treated with a combined therapeutic strategy (either surgery alone, or surgery combined with adjuvant treatment, and/or exclusive radiotherapy with or without chemotherapy) [2]. Primary and secondary prevention are key in H.N.C. management; hence, diagnosis and pre-treatment evaluations are of utmost importance[3, 4]. Such methods, usually would include otolaryngological examination, endoscopic evaluation, radiological and histopathological analysis of procured tissue. Evidently, diagnostic results are highly-dependant on the interpretations of pathologists, and so, inconsistencies and/or error in H.N.C. diagnosis, grading, and prognostication, are possible with significant impact on patients[4]. In biology and medicine, the use of advanced and complex computational methods (both chemo- and bio-informatics)

to help analyze large data sets is not new. Indeed, the large number of commercially-available software (use supervised learning methods: training data sets) continue to serve the purpose of screening small molecules and analysing large genomic (proteomic and metabolomic) data[5]. Recent advancements in artificial intelligence (A.I.) and in machine and deep learning techniques, allow us today to employ these methods to improve our decision making and prediction capacity; from medical and non-medical data sets[6]. Indeed, A.I., for example, has been also proposed to help in detecting malignant tumor and differentiating from benign tumor[7]. Further, A.I. techniques can be used concurrently with other technological approaches such as neural algorithmic networks (herein, mimicking the functioning of the human brain) or distinguishing normal versus pathophysiology of irradiation (radio-therapy; R.T.) and evaluate the involvement of the different molecular pathways, cellular, tissue-to-tissue interactions, and systemic responses. This is especially valuable as such factors are spatio-temporal (appear and disappear temporally over the landscape of the biological tissue or tissues)[8]. Indeed, when this large number of factors, which are interacting in a complex way, are what can determine disease, injury, or treatment outcome, then it is feasibly conceivable that the only way to understand and overcome such complexity is to use a computational device capable of processing and predicting a large number of probabilities and provide the best possible solution[9].

This perhaps explains the accruing RDI interest and attention provided to A.I. A.I., without any clinical or surgical supervision, will one day be able to understand and predict the afore-mentioned complexity and mediators and consequently, be able to suggest to us the possible countermeasure(s) targets, thereby improving our clinical diagnostic and therapeutic decision making and prediction capabilities[10].

Thus far, considering the speed or pace of A.I. progression, A.I. undoubtedly seems to shape the future of cancer and cranio-maxillo-facial RDI. It is perhaps a matter of a decade

or two before we would incorporate a quantum computing device equipped with the machine and deep learning methods, proficient in understanding human biology and distinguishing between processes in health and pathological scenarios, which ultimately, provide us with reliable prediction solutions for multi-factorial pathologies; R.T.-induced salivary gland damage and dysfunction in head and neck cancer patients, as well as in other diseases.

With the beginning of the 2023 academic year, this is an open call for our young dentists and surgeons (as well as educational/training curricula and programs) to consider acquiring a meticulous comprehension of A.I. that certainly will evolve patient care and our practice.

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