LETTER TO EDITOR

DELTA-RADIOMICS, A SIMPLE TOOL IN ASSESSING THE POTENTIAL FOR SEVERE EVOLUTION IN COVID-19 DISEASE

Roxana Irina Iancu[1,2], Camil Ciprian Mirestean[3], Anda Crisan[3,4], Alexandru Dumitru Zara[5,6], Dragos Petru Teodor Iancu[1,7]

[1]Gr. T. Popa" University of Medicine and Pharmacy, Iasi, Romania - [2]"St. Spiridon" Emergency Hospital, Iaşi, Romania - [3]University of Medicine and Pharmacy, Craiova, Romania - [4]County Clinical Emergency Hospital Craiova, Romania - [5]"Alexandru Ioan Cuza" University, Iasi - [6]Regional Institute of Oncology, Iasi, Romania

equal contribution of all authors

Keywords: *delta-radiomics, radiomics, features, Covid-19, chest x-ray, prognostic, predictive, ARDS.*

DOI: 10.19193/0393-6384_2021_4_308

Received *October 15, 2020;* ***Accepted*** *March 20, 2021*

The outbreak of the new coronavirus took place in Wuhan at the end of 2019 but soon the disease called by the World Health Organization (WHO) "COVID-19" produced a pandemic affecting Europe in turn, the most affected countries being Italy, Spain, Great Britain and France, later United States of America (USA) and now Latin America.

The development of measures to limit the effects of the pandemic and to quickly identify patients infected with the new coronavirus is becoming a priority in this context. Given the potential for rapid evolution to a severe form that associates acute respiratory distress syndrome (ARDS) but as recently demonstrated and coagulation disorders including pulmonary thromboembolism, the use of chest x-ray and computed tomography (CT) become essential imaging methods in COVID-19 disease diagnosis in addition to the real-time chain reaction of the reverse transcription polymerase (rRT-PCR) but also in the evaluation of the severity potential during the evolution of the disease. Artificial intelligence (AI), and more specifically radiomics, the method that uses features extracted from medical imaging to provide prognostic and predictive models in medicine has already proven useful in the differential diagnosis of COVID-19 pneumonia with pneumonia caused by influenza viruses. Also the characteristics of shape, texture, gray level matrix, intensity, entropy, fractal dimension and others have been introduced in complex models that include biological and therapeutic clinical data in order to develop models that can accurately predict the evolution of COVID-19 infection in different groups of patients.

Taking into account the impossibility of access to computer tomography services in middle-income countries, we propose a simple algorithm, based on the analysis of radiomic parameters variation (delta-radiomics) evaluated at short time intervals. These radiomics features can be easily extracted from digital chest x-rays. Currently, the "delta" variation of some radiomic parameters has demonstrated the ability to predict the complete pathological response on the operatory pieces, after neo adjuvant chemo-radiotherapy in rectal cancer, evaluating features

extracted from magnetic resonance imaging (MRI) performed before and after neoadjuvant treatment. Also, a model based on "delta-radiomics" could predict outcomes in non-small cell lung cancer (NSCLC) treated with radiotherapy.

We start from the premise that evaluation a delta-radiomics of some features, we can identify patients with higher risk of evolution to ARDS, but also cases in which "cytokine storm" is the predominant phenomenon in order to modulate therapy and anticipate the need for intensive care unit (ICU) patients admission. Delta radiomics can be a useful tool to complement the medical imagist physician opinion and can capture minor changes to the chest x-ray that cannot be discriminated by the eye of the observer.

References

1) M Fang, B He,L Li, et al. CT radiomics can help screen the Coronavirus disease 2019 (COVID-19): a preliminary study. Sci China Inf Sci. 2020; 63(7): 172103.
2) Marson FAL, Ortega MM. COVID-19 in Brazil [published online ahead of print, 2020 Apr 27]. Pulmonology. 2020;S2531-0437(20)30087-8. doi:10.1016/j.pulmoe.2020.04.008
) Zhao JY, Yan JY, Qu JM. Interpretations of "Diagnosis and Treatment Protocol for Novel Coronavirus Pneumonia (Trial Version 7)" [published online ahead of print, 2020 Apr 14]. Chin Med J (Engl). 2020;10.1097/CM9.0000000000000866.
4) SrHanumanthu. Role of Intelligent Computing in COVID-19 Prognosis: A State-of-the-Art Review. Chaos Solitons Fractals. 2020 May 29 : 109947.
5) Gillies RJ, Kinahan PE, Hricak H. Radiomics: Images Are More than Pictures, They Are Data. Radiology. 2016;278(2):563-577. doi:10.1148/radiol.2015151169
6) Fave X, Zhang L, Yang J, et al. Delta-radiomics features for the prediction of patient outcomes in non-small cell lung cancer. Sci Rep. 2017;7(1):588. Published 2017 Apr 3. doi:10.1038/s41598-017-00665-z
7) SH Jeon,CSong,KChie,et al. Delta-radiomics signature predicts treatment outcomes after preoperative chemoradiotherapy and surgery in rectal cancer. RadiatOncol. 2019; 14: 43.

Corresponding Author:
Mirestean Camil Ciprian
University of Medicine and Pharmacy, Craiova, Petru Rares no 2, Department of Oncology and Radiotherapy
Email: mc3313@yahoo.com
(Romania)