Artificial Intelligence in Oncology

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Perspective

Application of artificial intelligence in cancer patient care during COVID-19 pandemic

Shuhua Zheng [a]*, Yue Meng [b]

[a.] *Nova Southeastern University, College of Osteopathic Medicine, 33314, Florida, USA*
[b.] *The George Washington University Law School, 20052, DC, USA*

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The SARS-CoV-2, the virus that causes COVID-19, has imposed one of the biggest challenges in modern human medicine, with over 14 million confirmed cases and 610 thousand deaths since the virus first reported in January 2020 [1]. While different countries and regions had developed corresponding policies to modify post-COVID19 healthcare systems, the standards of care for cancer patients have been proven particularly difficult to adapt [2, 3]. Similar to patients with other chronic diseases such as hypertension, diabetes mellitus (DM), and chronic obstructive pulmonary disease (COPD), cancer patients have higher rates of developing COVID19 symptoms once contracted the virus [4]. While the management of other chronic diseases often only requires routine follow-ups, treatment regimens for malignancies are constantly tailored to incorporate a plethora of parameters unique for that particular patient [5]. For example, staging of the disease, a minute change in new imaging, laboratory results for genetic alterations, and even bodyweight fluctuation may entail a dramatic shift of treatment plans [5]. Furthermore, clinical management of cancer patients often requires a team of physicians who will be called upon once the patient's status changes. These physicians will make a group decision to modify chemotherapies, radiotherapies, and sometimes implementing surgical interventions [6]. Therefore, many cancer patients have struggled to receive proper treatment to prevent cancer progression while protecting themselves from contracting the virus during hospital visits. Inadequate supplies of medications and personal protective equipment (PPE), limited hospital capacity and physicians, vulnerability towards COVID19 and other infectious diseases further complicated the difficulty of proper care for cancer patients [7]. Even worse, newly emerging evidence showed that anti-SARS-CoV-2 antibodies developed after the virus contraction decay rapidly after recovery from the COVID19 [8]. All these facts warrant a long-term plan for cancer patient treatment during and after the pandemic. In this perspective, we will propose an applicable, straightforward workflow that integrates artificial intelligence (AI) in coping with this unprecedented crisis for better cancer patient care.

In the pre-pandemic era, board-certified radiologists must interpret one image every 3 to 4 seconds to meet the demand during a typical workday [9]. They are further stressed during the COVID19 pandemic with overwhelming new cases who have pulmonary pathological changes. Acquisition and analysis of oncological images may likely be deemed non-emergent or even elective, leading to further delay of image results interpretation. One major strength of AI is medical image analysis via deep learning training and neural networks [10, 11]. Despite recent progress in

* Corresponding author: Shuhua Zheng, Ph.D.
E-mail address: sz227@mynsu.nova.edu

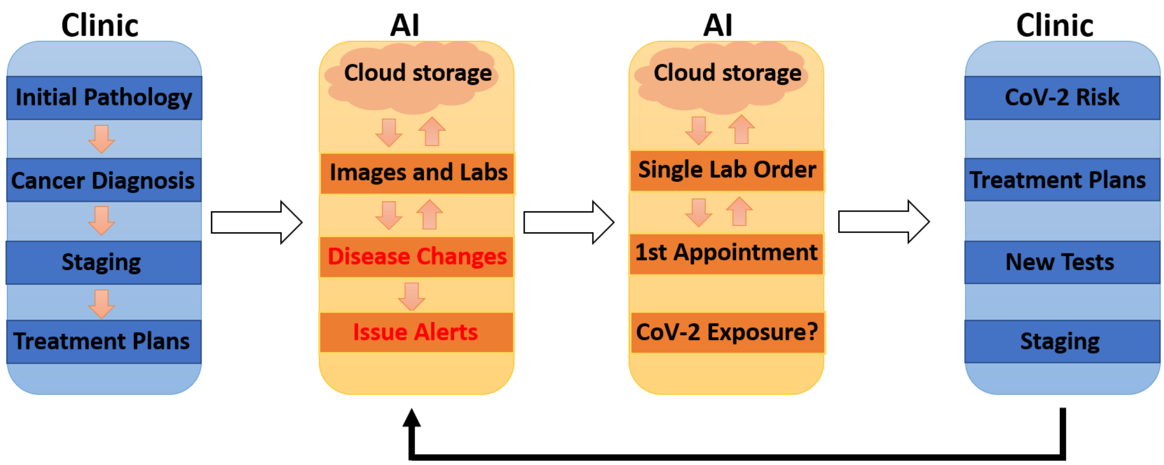

Figure 1. Schematic overview of the proposed workflow. Artificial intelligence can work independently in the monitoring of cancer progression, ordering appropriate lab and imaging tests. It may also alert physicians once changes in disease progression have been detected in lab works and images.

algorithms and software platforms, radiologists are responsible for verifying the accuracy of initial disease diagnosis, characterization, and staging [10]. Current versions of AI programs still lack reproductivity, limiting their applications in initial cancer detection. However, AI in its current version can readily facilitate cancer monitoring, with images from previous studies used for optimizations of algorithms. Furthermore, specific 'regions of interests' can be outlined based on previous images. Relatively simple tasks such as detection of increased intensities or new hot spots in positron emission tomography-computed tomography (PET-CT scans), texture changes in MRI, and increased sizes of lesions can be fulfilled and red-flagged by AI. Therefore, developing a 'simpler' version of programs that can be readily implemented for imaging-based disease follow-ups and disease progression-warming is of great potential in the post-COVID19 era (**Figure 1**).

Patients who had an AI red-flagged and radiologists confirmed disease progression might have to book an onsite visit of physicians' offices (**Figure 1**). The scheduling process can be automated by AI to select appropriate physicians in the cancer-care team and confirm it. Physicians may be capable of getting the treatment regimens ready and upload them onto the system without seeing the patient in person. For example, a radiation oncologist who had been automatically notified for the pathological change can have an on phone or video call with the patient to discuss treatment plans, especially when other physicians had checked the patient and uploaded recent physical exam results and vital signs. Meanwhile, AI can help eliminate overlapping orders of laboratory items and request a single order that can meet all testing requests made by the physician team. By doing so, it will further minimize office visits. To decrease the risk of transmitting the SARS-CoV-2 virus to other patients or health care workers during the visit, AI can also help in categorizing patients into groups of 'low-risk' or 'high-risk' in actively carrying the virus. The preliminary versions of these algorithms are indeed already in large scale usage. For example, a smartphone-based health code system was developed in China for categorizing citizens who had 'low-risk' or 'high-risk' in COVID19 exposure. A similar system with a strictly enforced patient privacy protection policy may help healthcare providers properly deploy appropriate PPE based on the risk contracting COVID19 during the encounter. Meanwhile, AI may indeed facilitate the decision in deferring in-person visits to telemedicine visits based on the basic inputs of patients' current conditions, laboratory and imaging results.

While the proposed AI-based workflow is far from perfection since it does not cover initial disease diagnostic visits and in-patient care, it may help reduce the burden on the overwhelmed healthcare system by optimizing the currently available resources. The AI programs based on the workflow hereby proposed are relatively easy to develop and will promote the entry of the first clinical application of AI in modern medicine (**Figure 1**).

References

1. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, Zhang L, Fan G, Xu J, Gu X, Cheng Z, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet. 2020; 395: 497-506. doi: 10.1016/S0140-6736(20)30183-5.
2. Yu J, Ouyang W, Chua MLK, Xie C. SARS-CoV-2 Transmission in Patients With Cancer at a Tertiary Care Hospital in Wuhan, China. JAMA Oncol. 2020. doi: 10.1001/jamaoncol.2020.0980.
3. Lewis MA. Between Scylla and Charybdis - Oncologic Decision Making in the Time of Covid-19. N Engl J Med. 2020; 382: 2285-7. doi: 10.1056/NEJMp2006588.
4. Richardson S, Hirsch JS, Narasimhan M, Crawford JM, McGinn T, Davidson KW, and the Northwell C-RC, Barnaby DP, Becker LB, Chelico JD, Cohen SL, et al. Presenting Characteristics, Comorbidities, and Outcomes Among 5700 Patients Hospitalized With COVID-19 in the New York City Area. JAMA. 2020. doi: 10.1001/jama.2020.6775.
5. Kurnit KC, Dumbrava EEI, Litzenburger B, Khotskaya YB, Johnson AM, Yap TA, Rodon J, Zeng J, Shufean MA, Bailey AM, Sanchez NS, et al. Precision Oncology Decision Support: Current Approaches and Strategies for the Future. Clin Cancer Res. 2018; 24: 2719-31. doi: 10.1158/1078-0432.CCR-17-2494.
6. Silbermann M, Pitsillides B, Al-Alfi N, Omran S, Al-Jabri K, Elshamy K, Ghrayeb I, Livneh J, Daher M, Charalambous H, Jafferri A, et al. Multidisciplinary care team for cancer patients and its implementation in several Middle Eastern countries. Ann Oncol. 2013; 24 Suppl 7: vii41-7. doi: 10.1093/annonc/mdt265.

7. Kutikov A, Weinberg DS, Edelman MJ, Horwitz EM, Uzzo RG, Fisher RI. A War on Two Fronts: Cancer Care in the Time of COVID-19. Ann Intern Med. 2020; 172: 756-8. doi: 10.7326/M20-1133.
8. Long QX, Tang XJ, Shi QL, Li Q, Deng HJ, Yuan J, Hu JL, Xu W, Zhang Y, Lv FJ, Su K, et al. Clinical and immunological assessment of asymptomatic SARS-CoV-2 infections. Nat Med. 2020. doi: 10.1038/s41591-020-0965-6.
9. McDonald RJ, Schwartz KM, Eckel LJ, Diehn FE, Hunt CH, Bartholmai BJ, Erickson BJ, Kallmes DF. The effects of changes in utilization and technological advancements of cross-sectional imaging on radiologist workload. Acad Radiol. 2015; 22: 1191-8. doi: 10.1016/j.acra.2015.05.007.
10. Hosny A, Parmar C, Quackenbush J, Schwartz LH, Aerts H. Artificial intelligence in radiology. Nat Rev Cancer. 2018; 18: 500-10. doi: 10.1038/s41568-018-0016-5.
11. Wang S, Yang DM, Rong R, Zhan X, Fujimoto J, Liu H, Minna J, Wistuba, II, Xie Y, Xiao G. Artificial Intelligence in Lung Cancer Pathology Image Analysis. Cancers (Basel). 2019; 11. doi: 10.3390/cancers11111673.