Platinum Editorial

The emerging role of Artificial Intelligence in the fight against COVID-19

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Introduction

Coronavirus disease 2019(COVID-19) pandemic caused by the SARS-CoV-2 has led to 6,097,313 cases and 505,626 deaths spread over 200 countries courtesy Worldometer, a product of Artificial Intelligence(AI) driven data analysis and real-time statistical visualisation. These alarming numbers keep changing every day. The commonest COVID-19 symptoms are fever, cough, breathlessness, anosmia and lack of taste with overwhelming human to human transmission[1]. The effect on all surgical specialities has been considerable with a reduction in urological capacity by up to 80%. Due consideration has been given to the triage of urological procedures with only the most urgent emergency operations and cancer procedures such as cystectomy, orchidectomy and radical nephrectomy taking precedence over radical prostatectomy, except for high risk disease[2]. This has included many patients with urological cancers and benign conditions, whose operations have been delayed, often detrimental. As we gradually return to more normal working patterns, for urologists, the tsunami is perhaps yet to come when we could potentially get overwhelmed with patients who finally feel safe enough to attend hospitals for their outpatient clinic appointments and operative procedures.

AI and COVID-19 thus far

Despite delays in the care of elective patients, the crisis has generated large volumes of clinical data which in its anonymised form can prove to be an invaluable resource towards answering a number of important questions for this and future pandemics. Using Natural Language Processing (NLP), which helps computers comprehend, analyse and generate human language, King's College London has designed the COVID Symptom Tracker. An AI based smart phone app called Zoe, which monitors viral transmission as well as symptoms [3]. The AI and Bluetooth powered NHSX contact tracing app warns users about viral exposure, dramatically reducing transmission rates. Alerts are triggered when app users self-report experiencing symptoms or testing positive, while respecting anonymity. Widespread testing has been difficult due to deficit of kits and centres and long waiting list for results. Seegene has used its AI based Big Data platform to create the Allplex™ Assay. It is a real-time RT-

PCR which detects N, E, and RdRP viral genes in a single reaction tube. It takes four hours to test 94 patients, is accurate and costs $20. Ten million such kits have been exported to over 60 countries.

The majority of COVID-19 patients exhibit chest CT features such as bilateral ground glass opacities or patchy shadowing. 4536 Chest CT images of 3222 patients spanning six hospitals formed the raw training and independent testing dataset for an algorithm designed by Infervision to tell the difference between COVID-19 and community acquired pneumonia [4]. Sensitivity and specificity was 90% and 96% respectively. This makes AI aided CT evaluation a robust, accurate and rapid tool in the fight against this disease. New York University's AI Predictive Analytic model showed 70-80% accuracy in quantifying the risk of ARDS; in this model, myalgia, elevated ALT and haemoglobin levels were highly predictive of clinical deterioration [5]. Cambridge University and NHS Digital's COVID-19 Capacity Planning and Analysis System (CPAS) can predict intensive care bed and ventilator demands using its Machine Learning (ML) algorithm. Such platforms can potentially reduce mortality through early warning signs and earlier intervention.

Cutting edge metagenomic Next Generation Sequencing (mNGS) is an unbiased, high throughput, massive parallel sequencing tool[6] which produces millions of nucleotide short reads. Using Artificial Neural Networks (ANN), with large datasets of raw transcriptomes as input and producing accurate genomes as output, NVIDIA Parabricks have revolutionised mNGS platforms, performing sequencing in about an hour and reducing costs. BenevolentAI used DL to create Biomedical Knowledge Graphs - networks defining inter-relationships between entities like proteins and drugs. An example is Baricitinib, used to treat arthritis, which blocks viral entry by preventing endocytosis [7]. AI has thus made some significant inroads into the discovery of potential treatments against our invisible enemy.

Why should it matter to urologists

Of particular interest to urologists is the finding that the entry of COVID-19 into nasal and bronchial epithelial cells is mediated by ACE-2 and TMPRSS2 [8]. The latter is commonly found in prostate

cancer and can potentially be inhibited by androgen deprivation therapy (ADT) or 5 alpha reductase inhibitors. Data was extracted from 9280 patients from 68 hospitals in Italy and included 4532 men with laboratory confirmed COVID-19 infection. Like in other nations, these men had more severe disease, were hospitalised more frequently and had worse clinical outcomes than women. Cancer patients in this study had a higher risk of COVID-19 infection when compared to those without cancer. In the general population in Veneto, prostate cancer patients receiving ADT has significantly lower risk of COVID-19 infection compared with those who did not receive ADT [9]. Based on these results, the authors came up with the hypothesis that ADT may have a partially protective effect against COVID-19. This clearly needs further investigation at a time when there does not appear to be any definite benefit from re-purposed drugs against COVID-19 except perhaps the use of Dexamethasone.

Large scale data analysis using AI, of COVID-19 in men on ADT and 5 alpha reductase inhibitors is currently underway. This involves adding questions about the use of these drugs within existing smart phone based apps which have now gathered data on many millions of patients, to see if statistical modelling and the use of AI algorithms can show a protective effect of these drugs against the virus by blocking the TMPRSS2 pathway. If this is the case then in vitro followed by in vivo studies in animal models of these drugs may demonstrate if they could potentially be used as prophylaxis to block the effects of the virus, while the hunt for an effective vaccine is underway. These important steps may help before these drugs can be studied in large scale clinical trials. Much however depends on the quality of the data input and refining the algorithms that are used for this purpose. The old adage “garbage in, garbage out” has never been truer. While time is of essence in this pandemic, we need high quality industry-academic-clinical partnerships with the best AI experts in all three domains working together to deliver solutions for patient and societal benefit.

AUTHOR CONTRIBUTION

All the authors contributed equally to the manuscript.

DECLARATION OF INTERESTS

The authors have no potential conflicts of interest to disclose.

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