Long COVID diagnosis: From diagnostic to advanced AI-driven models

The purpose of this manuscript is to review different aspects of long COVID-19 syndrome from clinical presentation to diagnosis, highlighting the considerable impact that AI can have.

In view of several reports, the definition of a new syndrome has been proposed, namely long COVID-19 syndrome. Care and management for COVID 19 patients do not conclude after acute infection but continue in the outpatient setting. Long COVID affects multi organ and shows Pulmonary, Cardiac, Vascular, Abdominal, Neurological and Psychiatric symptoms. Long COVID damage the respiratory system. The authors reported a reduction in forced vital capacity and forced expiratory volume. It reduced total lung capacity in 11%, and an impaired diffusing capacity of the lung. Analysis showed the characteristic of patients with persistent lung injuries, including male, overweight, comorbidity, oxygen therapy, ICU admission, and invasive mechanical ventilation. The authors of European Society of Thoracic Imaging and the European Society of Radiology document proposed a glossary of appropriate definitions to describe the lung abnormalities post COVID-19 pneumonia. The British Thoracic Society provided guidance for the respiratory follow-up for patients with COVID-19 pneumonia in two separate algorithms based on the severity of acute COVID-19 infection and ICU admission required. Study shows that the patients of Long COVID has chest pain, palpitation. Myocardial injuries have been described in research after SARS-COV 2 infection. The Canadian Cardiovascular Society Rapid Response Team provide guidance to health care providers for patients who still have symptoms 4 weeks after the start of acute symptoms and persistent or new unexplained chest pain, shortness of breath,frequent palpitations, and postural lightheadedness. Patients who recover from COVID-19 infection, may still live thrombosis due to endothelial dysfunction with a high prevalence of pulmonary vascular dysfunction. Researchers suggests a computed tomography angiography including VQ scintigraphy and dual-energy CT. Persistent neurological symptoms have been reported in COVID-19 survivors similar to chronic post-SARS and MERS syndrome.The symptoms include headaches, fatigue, hyposmia, hypogeusia, cognitive impairment, sleep disorders, pain, and Guillain-Barré syndrome. A recent prospective study on brain MRI findings indicated that COVID-19 survivors with no specific neurological symptoms exhibited brain micro-structure abnormalities and a decrease in cerebral blood flow after a 3-months follow-up. NICE guidelines suggested a multidisciplinary approach to identify, refer, and treat these patients.

The authors of this paper discuss the potential role of the multi-disciplinary approach with the support of AI. AI has numerous potential applications in diagnostic imaging, including image analysis, decision-making and prognosis prediction and these has been widely used in the fight against the COVID-19 pandemic. AI is able to differentiate COVID-19 pneumonia from community-acquired pneumonia and other lung conditions. deep learning model achieved high sensitivity (90%) and high specificity (96%)in the detection of COVID-19 using chest CT with an area under the curve of 0.96 and an average time for each CT scan of 4.51s. The authors reported that the disease outcome can be predicted with specificity greater than 82%, sensitivity greater than 86%, and accuracy greater than 84% . A deep-learning model combined CT imaging and clinical data of 1051 COVID-19 patients with the purpose to predict future deterioration to critical illness in those patients. This model demonstrated the ability to successfully stratify the patients into risk score group. AI system may also have a significant impact on pulmonary embolism detection, a condition that may be present in the clinical progression of COVID-19 patients during acute infection. AI models can also help to predict the structure of protein essential for the replication of the virus.