


CASE REPORT

Suspicion of pulmonary embolism after COVID-19 infection raised by a smartwatch

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Learning points for clinicians

Pulmonary embolism is an important complication of coronavirus disease 2019 (COVID-19). The clinical symptoms and signs of acute pulmonary embolism are non-specific. The smartwatch such as Apple Watch Series 6 can measure blood oxygen saturation. The smartwatch can be useful to detect pulmonary embolism after COVID-19.

A 50-year-old Japanese woman was referred to our hospital for assessment of dyspnea. One month before admission, she was tested for coronavirus disease 2019 (COVID-19) because of close unprotected contact with her husband with COVID-19. Her test was positive for COVID-19 without any symptoms and she was cured without any specific treatment. Four days before admission, she developed dyspnea with exertion and saw a primary care physician. Her peripheral oxygen saturation (SpO₂) was 94–98%. Chest radiography and electrocardiogram did not show any abnormal, thus she was referred to our hospital for further examination. Her medical history included pulmonary embolism (PE) due to remaining in the same position for a long time at the age of 42 years. She was on no medications. She had never smoked, and she drank alcohol 20 g/day. At our hospital, SpO₂ was 97%. However, her smartwatch (Apple Watch Series 7) had shown an SpO₂ of 88% in the early morning (Figure 1). Therefore, emergent computed tomography (CT) angiography of the chest was performed, and it showed filling defects in multiple branches of the pulmonary artery, which confirmed PE (Figure 2).

After admission, her respiratory condition worsened without hemodynamic instability. She required oxygen intake of 1 l/min

via nasal cannula. Ultrasonography of the legs showed deep venous thrombosis (DVT) in both soleus veins. She was anticoagulated with a direct oral anticoagulant, leading to symptom improvement. Oxygen administration was discontinued on Day 6. Screening tests for autoimmune disease and congenital coagulation abnormalities, such as activated protein C, activated protein S and anti-cardiolipin-β₂-glycoprotein I complex antibody, were all negative. She was discharged home on hospital Day 15.

Discussion

PE is an important complication of COVID-19. PE can develop not only in severe COVID-19 patients but also in asymptomatic COVID-19 patients. A meta-analysis showed that the pooled incidence rates of overall PE and DVT in patients with COVID-19 were 16.5% and 14.8%, respectively.¹ Cytokine storm induced by COVID-19 produces inflammatory cytokines that can trigger inflammation and a hypercoagulable state, resulting in intravascular microthrombosis.²

The clinical symptoms and signs of acute PE are non-specific and overlap with those of COVID-19.³ Unexplained hypoxemia with a normal chest radiograph is important to raise clinical suspicion of PE. The most widely used tool to measure peripheral SpO₂ in clinical practice is the pulse oximeter. Pulse oximeters are often used for patients with COVID-19 to monitor peripheral oxygen saturation.⁴ However, it is difficult to have the oximeter on the patient's fingers all day. In addition, the SpO₂ measured by conventional pulse oximeters sometimes has decreased accuracy in the presence of nail polish, low perfusion and skin pigmentation.

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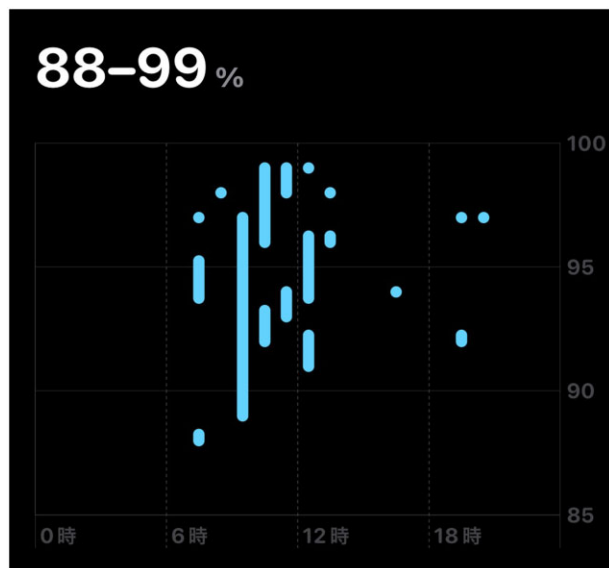


Figure 1. The Apple Watch indicates low oxygen saturation in the morning. Y-axis indicates oxygen saturation and X-axis indicates time course.

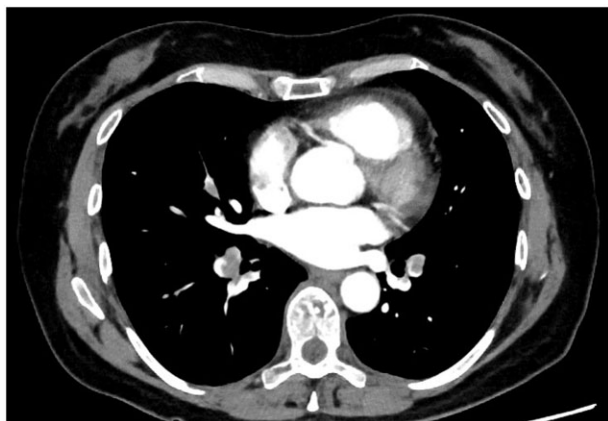


Figure 2. Chest contrast-enhanced CT shows filling defects in multiple branches of the pulmonary artery, which confirms pulmonary embolism.

Recently, wearable devices such as the Apple Watch have been developed to monitor vital signs. Smartwatch technology can identify arrhythmias while being non-invasive and less costly.⁵ Several diseases including atrial fibrillation have been detected by the Apple Watch.⁶ Since the Apple Watch Series 6, it can measure blood oxygen saturation. Pulse oximeters incorporated in wearable devices can be a simple method to monitor

SpO₂ at home. Several studies reported the accuracy and correlation between the smartwatch and pulse oximeters in the measurement of SpO₂.⁴ For example, Spaccarotella et al.⁴ reported a strong positive correlation between the Apple Watch Series 6 and standard commercial pulse oximetry for SpO₂ measurement. Such findings suggest that advances in smartwatch technology can contribute to the monitoring and early detection of various diseases.

It might be difficult to think PE without the data of her smartwatch. The smartwatch correctly recognized a low SpO₂, which led to the diagnosis of PE in our case. The smartwatch can be useful to detect PE after COVID-19.

Author contributions

S.S.: collected and analyzed the data and drafted the manuscript. Y.H. and E.D.: collected the data and participated in developing the concept of the manuscript. E.M.: participated in developing the concept of the manuscript and revised the article for important intellectual content.

Conflict of interest: None declared.

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