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MINI-FOCUS ISSUE: IMAGING

ADVANCED

IMAGING VIGNETTE: TECHNICAL CORNER

A Novel Diagnostic Method for Acute Pulmonary Thromboembolisms

An X-Ray Fluoroscopic Video Analysis Workstation

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ABSTRACT

Contrast-enhanced chest computed tomography is obviously the most frequently used method for diagnosing acute pulmonary thromboembolism (APE). We present a case in which a fluoroscopic video analysis workstation could potentially diagnose an APE and evaluate the improvement in the pulmonary circulation after anticoagulant therapy without either contrast media or a breath hold. (Radwisp PTE; jRCTs032200098) (**Level of Difficulty: Advanced.**) (J Am Coll Cardiol Case Rep 2021;3:941–3) © 2021 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

A 78-year-old woman with an old cerebral infarction was admitted to our hospital with a chief complaint of dyspnea. The patient's vital signs on admission were as follows: blood pressure, 140/80 mm Hg; heart rate, 110 beats/min; respiratory rate, 25 breaths/min; and peripheral oxygen saturation, 95%. Echocardiography showed a slight exclusion of the left ventricle, and blood sampling showed an increase in the D-dimer level (6 μg/ml). A Westermark sign was seen only in the right upper lung zone of the chest radiograph (**Figure 1A**). However, contrast-enhanced chest computed tomography (CT) identified thrombi in both pulmonary arteries (arrows in **Figure 1C**). On the same day, an analysis using the Radwisp (Paramevia Pte. Ltd, The central, Singapore), a fluoroscopic video analysis workstation with cineradiography on the basis of x-ray technology, was performed without contrast media or a breath hold of 20 s. A 10-min analysis, involving the application of a fast Fourier transform filter to the lung field and synthesis of a pseudo-color video from the frequency component corresponding to the heartbeat, revealed a defect in the pulmonary circulation governed by the vessels occluded by a thrombus on contrast CT (arrows in **Figure 1E,** Videos 1A and 1C). The woman was given a diagnosis of acute pulmonary thromboembolism (APE) and was treated with a direct oral anticoagulant agent for 20 days. After treatment, the Westermark sign disappeared from the chest radiograph (**Figure 1B**), contrast-enhanced CT showed no thrombi in the bilateral pulmonary arteries (**Figure 1D**), and an analysis using the x-ray fluoroscopy video analysis system showed full improvement in the pulmonary circulation over both lungs (**Figure 1F,** Videos 1B and 1D). The ambulatory patient was then discharged.

Recently, the incidence of venous thromboembolism, including APE, has been increasing all over the world, including in Japan (1). Contrast-enhanced chest CT is indispensable for diagnosing APEs, but its use is problematic in patients with renal dysfunction, which is commonly encountered in clinical practice (1,2). It is also challenging in patients with APE who are experiencing severe dyspnea. In such situations, the x-ray

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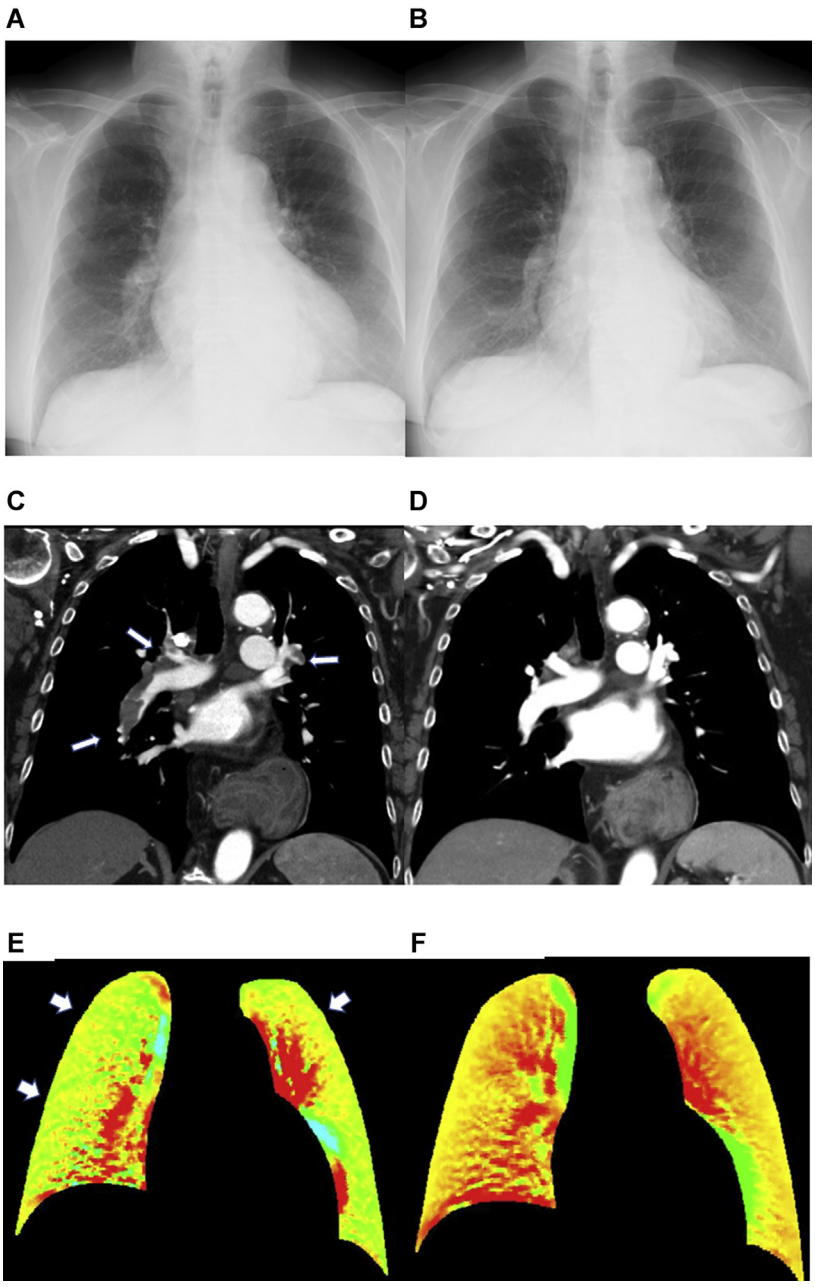
ABBREVIATIONS AND ACRONYMS

APE = acute pulmonary thromboembolism

CT = computed tomography

fluoroscopy video analysis system is very valuable for evaluating the pulmonary circulation without contrast media or a 20-s breath hold, and because this system is based on x-ray technology, patients are exposed to the same amount of radiation as with a general x-ray image. This case suggests the potential of the x-ray fluoroscopy video analysis system for noninvasive diagnosis, as well as for assessment of treatment efficacy after anticoagulant therapy in patients with APE. Further studies will be needed to clarify whether this technology can predict the size of the thrombus and whether high-quality images can be obtained when there is coexisting lung disease.

FIGURE 1 Imaging of Pulmonary Circulation



Chest radiograph **(A)** on admission and **(B)** after treatment. Contrast-enhanced chest computed tomography **(C)** on admission (**arrows** indicate thrombi) and **(D)** after treatment. Pulmonary circulation images created by the x-ray fluoroscopy video analysis system **(E)** on admission (**arrows** indicate perfusion defect) and **(F)** after treatment.

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KEY WORDS pulmonary circulation, thrombus, x-ray fluoroscopy

APPENDIX For a supplemental video, please see the online version of this paper.