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#### Case Report

### Novel assessment of retrospective on-demand analysis of venous thromboembolism by dual-layer spectral-detector CT

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#### ABSTRACT

Because the prognosis of pulmonary thromboembolism (PTE) will be often poor, early diagnosis and assessing severity at the first visit is important.

A 76-year-old man with suspected venous thromboembolism and a contrast deficit in the pulmonary artery (PA) was revealed by contrast-enhanced computed tomography (CT) imaging by dual-layer spectral-detector CT (IQon Spectral  $CT^{\mathbb{R}}$ , Philips Healthcare, Best, The Netherlands). The lung perfusion image showed decreased perfusion in the culprit lesion. The dual-energy analysis of the virtual monoenergetic imaging showed clear visualization of deep vein thrombosis (DVT).

In a 64-year-old man, an IQon Spectral CT<sup>®</sup> revealed a small contrast deficit in the PA. However, no perfusion abnormality was detected in the lung perfusion analysis.

The IQon Spectral CT<sup>®</sup> enables the detection of lung perfusion abnormalities in addition to PTE. The IQon Spectral CT<sup>®</sup> imaging may be useful for the "one-stop shop" evaluation of PTE and DVT.

<Learning objective: The prognosis of pulmonary thromboembolism (PTE) will be often poor, so early diagnosis and assessing severity at the first visit is important. The dual-layer spectral-detector computed tomography imaging for PTE, whereby the iodine map provided information regarding lung perfusion, whereas virtual monoenergetic images enabled clear visualization of deep vein thrombosis.>

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#### Introduction

Acute pulmonary thromboembolism (PTE) is a pathological condition in which thrombus forms mainly in the peripheral vein of the lower extremities and moves to the pulmonary artery by blood flow and occludes the pulmonary artery. Approximately 90% of acute PTE cases originate from the deep vein of the lower extremity [1]. In cases with massive PTE that occludes the pulmonary artery truncus or main pulmonary artery it is reported that more than 40% of patients die within several days after onset [2]. The mortality rate increases as the hemodynamics at the time

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of onset is poor, and life prognosis is poor in patients who develop cardiopulmonary arrest or severe shock (circulatory collapse). Thus, early diagnosis is expected to improve the prognosis by allowing an earlier start of treatment. As a result, determining an appropriate treatment strategy and assessing severity at the first visit is important.

#### **Case report 1**

A 76-year-old man with a history of chemoradiotherapy for a nasal tumor and associated neck lymph node metastasis presented to an emergency department with a left forearm fracture. Despite the absence of venous thromboembolism (VTE) symptoms (dyspnea, leg swelling, etc.), the plasma D-dimer level in the emergency department was 15.5  $\mu$ g/mL, and a VTE was suspected. The patient underwent contrast-enhanced computed tomography (CT) imaging by dual-layer spectral-detector CT (IQon Spectral

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CT<sup>®</sup>, Philips Healthcare, Best, The Netherlands). This instrument acquires both conventional images and dual-energy images by measuring the low-energy regions of the emitted spectrum from the upper layer of the detector and high-energy regions from the deeper layer of the detector, allowing for the measurement of iodine density as well as clear visualization of thromboembolism. The CT images revealed a contrast deficit in the right superior pulmonary artery (Fig. 1A). The lung perfusion image from the dual-energy analysis showed decreased perfusion in the right upper lobe (Fig. 1C), and the iodine density of the lung was lower in the right upper lobe than in the left upper lobe (0.9 mg/mL vs 2.5 mg/mL). The patient was diagnosed with VTE [non-massive PTE]

and deep vein thrombosis (DVT)], and anticoagulation therapy with 60 mg of edoxaban (Lixiana<sup>®</sup> and Savaysa<sup>®</sup>, Daiichi Sankyo, Inc., Tokyo, Japan) daily was initiated. The follow-up contrastenhanced CT performed 18 days after the initiation of anticoagulation therapy revealed that the thrombi had disappeared (Fig. 1B) and the lung perfusion had improved (2.6 mg/mL vs 2.6 mg/mL lung iodine density in the right and left upper lobe, respectively) (Fig. 1D).

We conducted a delayed-phase CT scan 5 min after the contrast injection to evaluate DVT. The results showed a thrombus in the left lower extremity (peroneal vein, soleal vein, and popliteal vein) (Fig. 1E). The dual-energy analysis of the virtual monoenergetic

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