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IMAGE OF THE MONTH

First-time rest-stress dynamic whole-body ^{82}Rb-PET imaging using a long axial field-of-view PET/CT scanner

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Recently, long axial field-of-view (LAFOV) PET/CT scanners have been introduced, which yield a substantial increase in sensitivity compared to standard scanners [1, 2] and allow for acquiring whole-body dynamic imaging [3]. This may constitute the basis for a new diagnostic concept in cardiovascular imaging, e.g. in patients with suspected or known coronary artery disease (CAD).

Recent evidences highlighted the interconnection between ischemic heart and other organs such as brain [4] or kidney [5, 6], consistent with the concept that CAD is linked to a systemic disease.

We performed a whole-body rest/stress perfusion with [^{82}Rb]Cl PET using a Biograph Vision Quadra™ PET/CT (Siemens Healthineers, Knoxville, TN, USA). A 57-year-old female patient presented with atypical chest pain, without history of CAD nor known cardiovascular risk factors. Both at rest and during stress, images were acquired over 7 min in list mode immediately following an intravenous administration of 407 MBq (11 mCi) [^{82}Rb]Cl. Pharmacological stress was induced with Regadenoson (400 mcg).

Images were reconstructed using a dedicated image-reconstruction prototype (e7-tools, Siemens Healthineers) in a dynamic fashion in cine-mode and further displayed as static images corresponding to different time intervals from the injection. In the upper row of the image, rest imaging is displayed featuring 0–30 s (a), 30–60 s (b), 60–120 s (c) and 120 s–7 min (d) from the injection, respectively. In the bottom row, for stress imaging: 0–30 s (f), 30–60 s (g), 60–120 s (h) and 120 s–7 min (i), respectively. Homogeneous perfusion of the myocardium was shown (e, rest and l, stress).

The activity flows rapidly through the peripheral venous system, also distributing in the pulmonary vessels (a,f). Right after, the arterial vessels of the whole body and both kidneys can be visualized (b,g). Then, salivary glands, thyroid, spleen and liver can be seen. Also, starting from 60 s post-injection the LV-myocardium is fully visualized (c,h). Time-activity curves on LV-Myocardium and on both kidneys could be derived from dynamic data (m) and showed an increase in myocardial blood flow after injection of Regadenoson. Despite a similar appearance on static images, renal flow was significantly lower for the right kidney compared to the left organ. Furthermore, while the flow was similar on rest and during Regadenoson stress on the left side, there was a further slight decrease in flow after injection of Regadenoson on the right side.

The images reconstructed at the latest time point show increased spleen-to-liver activity ratio in rest conditions than in stress (d, l, red arrows). The splenic switch-off is known when using Regadenoson as stressor [7] and with whole-body imaging it can be used to identify inadequate vasodilatory response. Renal function may also be effectively evaluated, consistent with recent reports [8].

^{82}Rb-whole body PET imaging on LAFOV scanners also bears the potential for insightful investigations on the relationship between perfusion status and function in other organs, e.g. hyperperfusion in the thyroid that can be associated to a thyroiditis [9]. Unfortunately, ^{82}Rb PET did not show as suitable to assess brain perfusion [10, 11].

The use of LAFOV PET/CT scanners in whole-body perfusion imaging goes beyond the concept of "pretty images". Besides an improvement of image quality and a substantial reduction of administered dose, the simultaneous dynamic whole-body acquisition opens the door for the investigation of the intimate connections of various organs in the assessment of patients with suspected CAD.

This article is part of the Topical Collection on Cardiology

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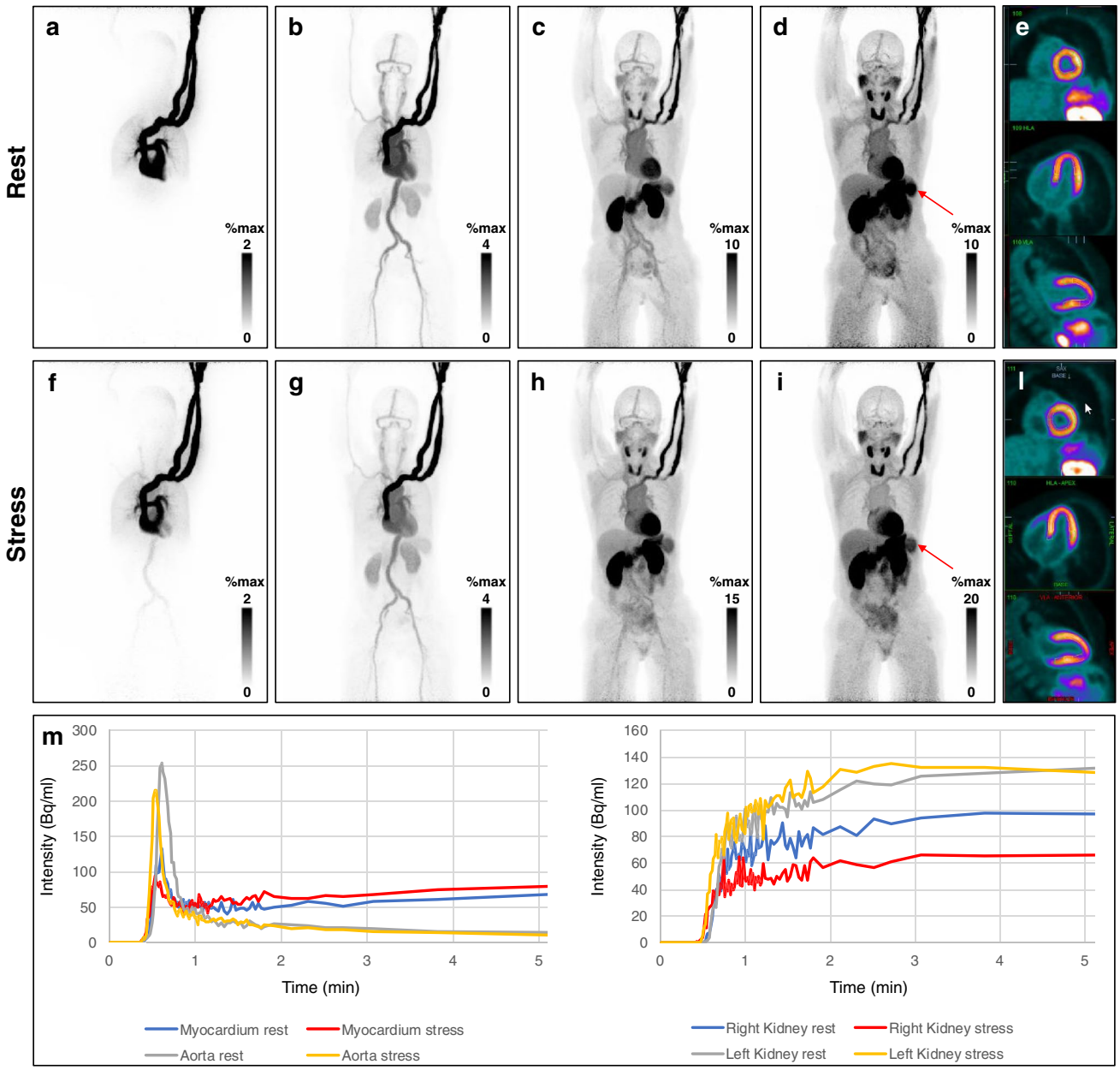

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Data Availability Data will be made available upon reasonable request.

Declarations

Consent to participate Informed consent was obtained before the start of the acquisition on the LAFOV PET/CT system. Patient gave written informed consent to anonymously use their clinical and imaging data for publication.

Conflict of interest Hasan Sari is an employee of Siemens Healthcare AG. Federico Caobelli is currently supported by a research grant by Siemens Healthineers for matters not related to the present manuscript. Axel Rominger has received research support and speaker honoraria from Siemens. The other authors declare no competing interests.

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