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Editorial/*Thoracic imaging*

Spectral photon counting CT: Not just a pimped-up new version of dual-energy CT

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Spectral photon counting computed tomography (SPCCT) is emerging as a new technology with the potential to overcome some of the common limitations of CT systems equipped with energy-integrating detectors. In this issue of *Diagnostic & Interventional Imaging*, Jungblut et al. investigated the utility of SPCCT to discriminate between empyema and reactive pleuritis, an application not yet assessed in the literature [1]. Interestingly, these researchers decided to restrict their analysis to only some of the theoretical advantages offered by SPCCT. In fact, the use of photon counting detectors in SPCCT systems results in improved spatial resolution, reduced noise, improved spectral resolution [2–5].

So far, attention on human applications of spectral imaging with SPCCT has been dedicated to improved visualization of the lumen of cervical [2,3], intracranial [4] and coronary arteries [5], and calculation of extracellular volume of the left ventricle [6]. Nevertheless, all types of applications previously evaluated with dual-energy CT (DECT) scanners are expected to benefit from spectral reconstructions with SPCCT at least as much as with DECT. For thoracic structures, these applications include, among others, the assessment of lung perfusion [7] and detection of embolic perfusion defects, septic [8] or not [9], the assessment of first pass myocardial perfusion [10,11], the reduction of the volume of contrast material needed for coronary artery evaluation [12] and the reduction of acquisitions needed to detect intramural hematoma of the aorta [13]. Mono-energetic and iodine maps are among the most often used spectral images because that can help boost the presence of iodine and make identification and quantification easier. In their article, Jungblut et al. showed that, as expected, at low mono-energetic energies, the signal-to-noise and contrast-to-noise ratios of infected pleura are greater than those observed on conventional CT images and greater than those of non-infected pleura [1]. In addition, they found that the use of iodine maps increases readers' confidence for discriminating between empyema and non-infected pleural effusion [1].

Nevertheless, SPCCT is more than a DECT with energy-integrating detectors. As already mentioned, among their most interesting properties are improved spatial resolution and less electronic noise. These properties have been assessed and confirmed in recent human studies for vascular and lung imaging, with the use of voxels in the order of 200–250 μm and high matrix sizes of 1024 $\times$ 1024 [2,5,14]. With these parameters, pleural fissures are very nicely depicted [14]. Nevertheless, the potential benefits from high resolution were not yet exploited to study pleural pathology. Among the artifacts reduced with SPCCT are beam hardening artifacts, as confirmed in human studies, especially in the paravertebral region [15]. This is of particular interest for lung imaging, as it is the region where early lesions of interstitial lung diseases appear, but also for the assessment of pleural effusions. Also these advantages are still unexplored.

Regarding the possibility to combine the very high spatial resolution of SPCCT together with spectral properties, it should be noticed that this remains a field completely open for investigation since, so far, only one study has reported its use [5]. While further studies are likely to confirm that knowledge gathered from DECT is applicable also on spectral images obtained with SPCCT and to show further improvements, SPCCT has the potential to bring more revolutionary changes to CT imaging thanks to the so-called K-edge imaging and the development of new contrast media specifically designed for this type of imaging going towards molecular and theranostics imaging [16,17].

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Abbreviations: CT, Computed tomography; DECT, Dual-energy CT; SPCCT, Spectral photon counting computed tomography

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The author attests that she meets the current International Committee of Medical Journal Editors (ICMJE) criteria for Authorship.

Disclosure of interest

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