At the heart of innovation: cardiac imaging in 2019

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Cardiac imaging is a rapidly evolving space with numerous substantial developments. New imaging technologies were developed over the last decades, allowing for improved morphologic and functional assessment of the heart. The year 2019 was a particularly exciting year for cardiac imaging.

The role of coronary CTA became more prominent due to the 2019 European Society of Cardiology guidelines for the diagnosis and management of chronic coronary syndromes [1]. Non-invasive functional imaging for myocardial ischemia or coronary CTA is now recommended as the initial test for diagnosis of coronary artery disease in symptomatic patients if obstructive coronary artery disease could not be excluded by clinical assessment alone. Although coronary CTA is known for its high sensitivity, the specificity is less optimal. Functional techniques such as CT-based fractional flow reserve [2–6] and myocardial CT perfusion [7–9] have the potential to improve detection of functionally significant coronary artery disease [10]. In addition, van Hamersvelt and colleagues [11] showed that the diagnostic accuracy for identification of functionally significant stenosis in patients with intermediate-degree coronary stenosis on CTA improved by a deep learning approach of the left ventricular myocardium. The deep learning method first automatically segmented the left ventricular myocardium, subsequently characterized it, and finally classified patients into those with or without functionally significant coronary artery stenosis.

Other journals also published important cardiovascular imaging studies in 2019. Mack et al [12] compared transcatheter aortic valve replacement (TAVR) and surgical valve replacement in low-risk patients with severe aortic stenosis (PARTNER 3 trial). Their *New England Journal of Medicine* paper showed a lower rate of a composite of death, stroke, and rehospitalization 1 year after TAVR. With potentially expanding TAVR indications to lower risk patients, adequate pre-TAVR imaging analysis becomes even more

important. Francone et al [13] published a European Society of Cardiovascular Radiology (ESCR) consensus document for CT and MR imaging prior to TAVR. The authors provide a reference document for CT and MR acquisition techniques, which takes into account the significant technological variation of scanners. They also reviewed required measurements and defined a step-by-step approach for these measurements. Lastly, they proposed a CT/MR reporting template to stimulate consistent communication between different hospitals and between medical specialists involved in the procedural planning of TAVRs.

One of the 10 most downloaded cardiovascular European Radiology publications from 2019 was about diagnosing infective endocarditis. Echocardiography is currently the reference standard. Hryniewiecki et al [14] evaluated the usefulness of cardiac CT in the diagnosis of infective endocarditis and its perivalvular complications and found that CT is a useful modality in addition to echocardiography. The overall sensitivity of combined echocardiography and cardiac CT improved especially for detection of abscesses and pseudo-aneurysms.

Another important study in the cardiac imaging field came from the multicenter cardiac MRCT Registry of the European Society of Cardiovascular Radiology (ESCR). In general, gadolinium-based contrast agents for MR imaging are considered relatively safe. When administered for cardiac MR, gadolinium is routinely combined with pharmacological stressors such as regadenoson and adenosine, which may influence the incidence of acute adverse events. Uhlig and colleagues [15] evaluated the likelihood of gadolinium-associated acute adverse events in cardiac MR in a large registry of 72,839 patients. The large sample size allowed for statistical adjustment for potential confounders such as stress test imaging, main indications, age, and sex. The results indicated that acute adverse event rates in cardiac MR with gadolinium-based contrast were low (0.36%), especially for severe adverse events (0.033%). Stress cardiac MR resulted in more frequent mild and moderate adverse events.

The recently published results of the Dutch–Belgian lung cancer screening trial (Nelson trial) indicated that lung cancer mortality was reduced in the low-dose CT screening arm [16]. Since the National Lung Screening Trial (NLST) in the USA

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showed similar results in 2011 [17], one can expect that the number of CT scans of the chest will increase. Even without the potential launch of new lung cancer screening CT programs, the annual number of CT scans is increasing yearly with 6.5% [18]. The probability that chest CT scans will reveal cardiovascular findings is substantial, especially in a high-risk lung cancer screening population. Krueger and colleagues [19] realized the importance of incidental cardiac disease on un-gated chest CT scans and published a pictorial review for non-cardiovascular radiologists in *Insights into Imaging* on this topic. Among others, they describe cardiac shunts, chamber enlargements, and diseases of the valves, coronary arteries, cardiac walls, myocardium, and pericardium. The review paper does not only describe these clinically significant cardiac findings as seen on chest CT, but also explains further management strategies.

These papers are just a small sample of the incredible number of innovative studies on cardiac imaging that was published in our journal and other journals in the year 2019. We are excited to see this trend continuing in 2020 with more important cardiac imaging studies focusing on novel developments ranging from improved functional coronary assessment to artificial intelligence.

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Compliance with ethical standards

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Methodology

• Editorial

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