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Risk & Danger

New indications for coronary CT angiography

The time has come

The latest in CCTA and how the quality and timeliness of diagnosis can be improved.

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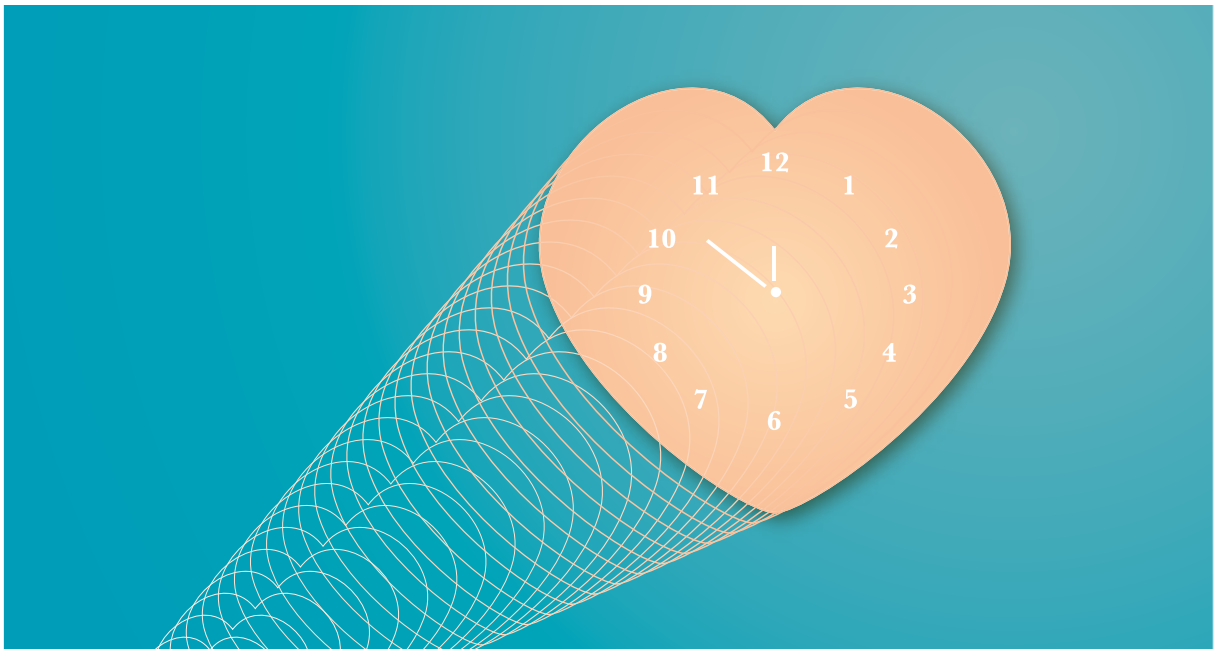

Since the beginning of the 21st century coronary computed tomography angiography (CCTA) has turned from a research tool with ill-defined indications into the recognised cardiac imaging modality with proven clinical and prognostic values. There is already a myriad of single-centre studies and over a dozen multicentre trials where the results of CCTA were compared with coronary catheterisation (as a gold standard), with very good results, favouring the use of CT for coronary imaging. CCTA has been responsible for helping us bring into practice one of the greatest physician's dreams about realisation of noninvasive visualisation of coronary arteries.

Looking into the literature one can see that the diagnostic accuracy of modern CT systems, in general, is the same as has been reported in the years 2006-2010 for the previous generation of 64-128 row scanners. But modern types of CT scanners open up the opportunity to reach significant improvements of image quality of coronary arteries and heart structures even in "difficult" patients (ie ones with arrhythmias or overweight) and to get high-quality diagnostic images with very low radiation exposure and less volume of contrast media. The decrease of tube current and voltage leads to increase of measured densities of iodine on CT images and better signal-to-noise ratios. Increase in image noise due to lower tube settings is compensated with help of iterative reconstruction and new types of detectors. The contemporary standard of CCTA is prospective-gated (variants: high-pitch or even ungated), wide-detector or dual-source acquisition with iterative image reconstruction.

Traditionally cardiologists and radiologists were mostly concerned about the detection of so-called significant coronary stenosis, causing myocardial ischaemia. In the recent past, both noninvasive CCTA and invasive cardiac catheterisation) were used for getting just anatomical information about degree and location of the coronary stenosis. However, today in cardiology we have seen an obvious shift to an increased use of functional imaging for assessment of coronary stenosis with analysis of fractional flow reserve (FFR) as a new reference standard.

Stress echocardiography, single-photon emission

computed tomography (SPECT) and perfusion magnetic resonance imaging (MRI) are the cardiac imaging modalities which traditionally are used for noninvasive detection of myocardial ischaemia, and they are recommended for this purpose in different national and international guidelines.

Modern CT scanners also allow the opportunity to study rest and stress myocardial perfusion and to combine these data with the results of noninvasive CCTA. Such an approach improves the specificity of CCTA and decreases the need for cardiac catheterisations. Perfusion myocardial CT has been well validated in several trials using both cardiac catheterisation and FFR measurements as reference standards. There are also are some other new technologies for assessment of coronary blood flow with the help of CCTA.

Probably the most interesting one is a noninvasive assessment of FFR with CT (FFR-CT) using sophisticated computer analysis. This method has been validated in several multicentre trials and attracted a lot of attention from both cardiologists and radiologists. The use of CCTA in clinical trials for detection of vulnerable plaques and stratification of patients according to the severity of coronary atherosclerotic burden has already brought very promising results concerning the assessment of patient prognosis and selection of optimal treatment plans.

> “‘SWISS KNIFE’ TOOL FOR NONINVASIVE CARDIAC IMAGING”

There is a strong probability that CCTA turns into a ‘Swiss knife’ tool for noninvasive cardiac imaging. Besides coronary and perfusion imaging, it is approaching cardiac MRI (a recognised reference standard for myocardial imaging) in the assessment of different myocardial diseases. For example, many years ago it was shown that cardiac CT and cardiac MRI gave the same results about size, volume, and function of heart chambers. Now, after the development and implementation of dual-energy CT, radiologists have more interesting opportunities. Dual-energy CCTA could be used for myocardial characterisation practically for the same indications as cardiac MRI—eg for detection of post-infarction myocardial scars, myocarditis and cardiac amyloidosis. Besides this, dual-energy coronary CT helps to eliminate artefacts from calcified plaques obscuring the lumen of coronaries.

Recent changes in cardiological paradigms about approaches to diagnosis, treatment, and assessment of prognosis in patients with coronary artery disease (CAD) together with the technical development of CCTA and accumulation of scientific data proving the high diagnostic value of CCTA have resulted in very interesting perspectives concerning the use of this modality for noninvasive coronary imaging.

Current cardiological and radiological guidelines recommend the use of CCTA in patients with a low or intermediate probability of obstructive coronary artery disease or in patients with acute chest pain and low probability of acute coronary syndrome. It is a big step forward, but today these recommendations look too limited and conservative. For example, in contrary to perfusion MRI and SPECT, myocardial perfusion CT of FFR-CT so far are not included into imaging guidelines (except for National Institute for Health and Care Excellence [NICE] (UK) guidelines which recently supported use of FFR-CT and it is a good sign) (National Institute for Health and Care Excellence 2017).

But thanks to an accumulation of top-quality scientific evidence, today we are witnessing a process of steady transition from the use of CCTA as a pure ‘niche’ diagnostic tool dedicated to imaging of some limited categories of coronary patients to the implementation of this modality into the core of cardiovascular diagnostics. Recently several important clinical trials have demonstrated that appropriate use of CCTA improves the quality and timeliness of diagnosis and that it has a marked positive impact on the selection of the best treatment strategy, patient prognosis and healthcare costs.

It looks likely in the near future that the clinical indications for the use of CCTA will be significantly expanded and the current guidelines for the management of patients with acute and stable coronary artery diseases will be updated and revised.

In this situation cooperation between radiologists, cardiologists and nuclear medicine specialists has been gaining more and more importance. Understanding the significance of the team approach to cardiac imaging, the European Society of Radiology (ESR) has recently signed a Memorandum of Understanding with the ESC-EACVI (European Society of Cardiology, European Association of Cardiovascular Imaging), EANM (European Association of Nuclear Medicine) and ESCR (European Society of Cardiovascular Radiology). It is just a first, but important step ahead for better use of modern cardiac imaging modalities (first of all, CCTA) for the benefit of patients and public healthcare. ■

REFERENCE

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