Cardiac scanning was the driving force behind recent developments in computed tomography (CT) that saw the introduction of multi-detector imaging as well as innovations such as dual-source flashers and wide 64-slice detectors. The next five years will see the development of a combination of CT angiography (CTA) and CT perfusion as a one-stop shop for cardiologists, according to Professor Mathias Prokop. Radiologists will be able to offer examinations including stress tests capable of predicting the presence of ischemia equally as well as SPECT.

Prof. Prokop and his group at the Radboud University Medical Centre are looking forward to a day when CT perfusion can offer functional diagnosis throughout the body, starting with applications in the brain but spreading to oncoplastic and functional imaging.

The challenge is to create good-quality perfusion scans at an acceptable radiation dose. If perfusion imaging was done using conventional settings for each time point of a perfusion series, then radiation dose would have to be multiplied by the number of scans, and thus be larger than current techniques by a factor of 20-40. Since freezing patients is not an option, low-dose approaches are being developed that can achieve perfusion imaging at competitive dose, but these approaches so far struggle with reduced image quality. He went on to explain that the major issue as the key issues and is working on developing techniques for high-quality perfusion at acceptable dose levels. Widespread use of perfusion imaging is not achievable unless we can bring down the dose.' He said: 'That’s the message.'

So, now that the Slice Wars have settled, where are we with CT imaging?

Prof. Prokop: ‘Cardiac imaging used to be the driving force behind new CT developments. Today we can deliver pretty good quality imaging of cardiac morphology in almost all cases, though the technique is not completely fool proof. All the new generation scanners beyond 64-slice are capable of good-quality cardiac work. Cardiac imaging is especially simple with the scanner we use, which is a Toshiba 320-slice unit. In a fraction of patients there’s a bit of a problem left with motion correction. GE Healthcare recently introduced a software approach to estimate the movement of the coronary arteries and use this information during image reconstruction to counteract this motion and improve sharpness and contour delineation of the coronary arteries. I expect this technology will spread to the other vendors who are already playing with it. Philips it was the first to publish, but hasn’t yet implemented the technique in their clinical software.

A big issue we have currently with cardiac CT is that cardiologists tell us it’s nice to know the coronary morphology, but that it is more important to know whether a stenosis is functionally relevant. This information is important for deciding whether to treat this stenosis or not. Until very recently we were not very good at answering this question because, while we could see disease, we said anything about collateral vessels or whether the stenosis caused a malperfusion of the myocardium.

Is CT really a viable modality to assess the human heart?

Assessing the functional significance of a stenosis is a topic that is still under development and will remain so for the next few years, but it will get done. The current technique uses adenosine vasodilation for testing and a scan at a time point where there is the biggest difference in perfusion between normal- and ischaemic myocardium. The technologists will be able to look at all the dynamic information from these ultra-low dose scans, though the technique is far from being enhanced during the time of scan arrival. The result is that you cannot rely on a conventional CTA if it does not display the heart because it may still be there but not yet enhanced, while the timing-invariant technique will always show them if they are there at all.’

You’ve worked in Japan with Toshiba, on phantom models relating to the VISION Edition of CT scanners. What can we expect to see?

‘We have a Toshiba grant to develop a phantom that allows us to play around with the CT acquisition parameters without having to expose patients to radiation. It allows us to determine the impact of the hardware on the processing and post-processing parameters to optimise the image quality. We need models that allow us to study the influence of each variation we are testing on the accuracy of perfusion measures, noise, spatial resolution, signal-to-noise ratios and, ultimately, visibility of small perfusion abnormalities, such as lacunar infarcts. ‘The phantoms need to be organ-specific to replicate the noise that comes from real scanning. The noise in the brain is, of course, different from the chest, for example. We can create a phantom for the brain. We will probably develop such a phantom for the abdomen, and then one for the chest. Toshiba has fully embraced this approach.’

You are updating your best-selling book ‘Spiral and Multi-slice Computed Tomography of the Body’. What can we expect to see in the new edition?

‘We hope it will come out at the end of this year. Our goal is to include the new models and the new information that is significant in the new edition is the latest technology, such as perfusion imaging. We have the field going from dual-energy, dual-sequence, dual-volume, as well as the related subject of dual-energy and subtraction imaging for contrast-enhanced studies. We are now applying the same techniques we use to extract information from perfusion scans to subtraction imaging, another powerful tool for creating injection maps at various times post contrast injection. The resulting high-resolution maps look pretty cool and will probably revolutionise the way we look at contrast-enhanced studies.’

Mathias Prokop trained as a radiologist at Hanover Medical School, Germany and gained a BSc in Physics at Maburg University, Germany. From 1998 he was an Associate Professor of Radiology at the University of Vienna Medical School, Austria. He went to the Netherlands in 2002 and became Professor of Radiology at UMC Utrecht in 2004. In 2007 Dr. Prokop was appointed Professor of Radiology at Radboud University Nijmegen as well as Chairman of the Department of Radiology. Dr. Prokop is an expert in body imaging with a special focus on multislice CT and the latest technical developments the past decade he has concentrated on chest scanning using CT (cancer, cardiovascular disease, COPD) and has been a major player in the Dutch Belgian lung cancer screening trial (NELSON).