

ABSTRACT

Non-invasive coronary computed tomography angiography (CCTA) has become an important tool for visualisation of coronary arteries since the introduction of 64-channel detector CCTA in 2004. It has been proved to be especially beneficial for ruling out coronary artery disease (CAD) in selected patient populations, due to the high negative predictive value (NPV).

The aim of this thesis was to study some aspects of the introduction, establishment and development of a new method, retrospectively ECG-gated CCTA with 64-channel detector, to evaluate coronary arteries.

In *study I* the diagnostic capacity and limitation of CCTA was compared to that of invasive coronary angiography (ICA) in a newly established CCTA team. CCTA had a very high NPV but the number of non-diagnostic scans was also high. The main limitations were motion artifacts and vessel calcifications, while short experience in reading CCTA did not affect image interpretation.

Study II described the learning-curve effect of the interpretation of 100 CCTA and also compared the diagnostic accuracy of both radiologists and radiographers, after a common introduction. The review time for novices was approximately halved during the first 100 cases, with maintained diagnostic accuracy. There was a learning-curve effect in positive predictive value (PPV) for radiologists, but not for the radiographers. However, the diagnostic accuracy of dedicated radiographers indicated that they might be considered as part of the evaluation team.

Study III compared the radiation exposure in retrospectively ECG-gated CCTA and ICA in the same population. Both mean estimated effective dose (ED) and organ doses (skin, breast, lung and oesophagus) were higher in CCTA when compared to ICA. The relatively high radiation dose to breast indicates that bismuth shielding should be used in women when performing CCTA. When using the updated tissue weighting factors provided in ICRP 103 the calculated ED from CCTA were significantly higher than those obtained using outdated ICRP 60.

In *study IV* the image quality and radiation doses were compared when decreasing X-ray tube peak kilovoltage (kVp) from 120 to 100 kVp in patients undergoing CCTA. By reduction of tube voltage the radiation dose was almost halved while the diagnostic image quality was kept at a clinically acceptable level.

In conclusion, CCTA is increasingly available throughout the world as an alternative to gold standard ICA, especially due to the excellent capability to rule out CAD. Still, retrospectively ECG-gated 64-channel detector CCTA has limitations such as motion artifacts and vessel calcifications. Another limitation is the high radiation doses required for CCTA compared to ICA. By lowering the kVp from traditionally 120 kVp to 100 kVp the radiation dose is halved while retaining diagnostic accuracy. There is a learning curve effect (regarded PPV and review time) of the interpretation of CCTA. However, more than 100 reviewed CCTA cases are necessary to reach a diagnostic accuracy that is acceptable.