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Coronary computed tomography angiography in coronary artery disease: From diagnosis to prevention

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Statement of the Problem: Coronary Computed Tomography Angiography (CCTA) has been increasingly used as a less invasive modality in the diagnosis of coronary artery disease. With rapid technological advances in CT scanning techniques, clinical applications of CCTA in coronary artery disease have shifted from the traditional visualization of coronary lumen stenosis to physiological assessments of functional significance of coronary plaques and plaque features. This allows for identification of high-risk plaques or high-risk patients for developing adverse cardiac events.

Methodology: This presentation provides an overview of clinical value of cardiac CT in coronary artery disease with a focus on five stages of cardiac CT applications ranging from angiographic evaluation to physiological assessment of coronary plaques.

Findings: CCTA applications are presented to demonstrate the quantitative assessment of coronary plaques in terms of plaque features, such as calcified, non-calcified and mixed plaques with the aim of identifying high-risk plaques. CCTA is also able to provide functional assessment of myocardial ischemic changes, thus predicting cardiac events. Furthermore, CCTA-derived Fractional Flow Reserve (FFRCT) allows for detection of lesion-specific ischemia, with high accuracy than CCTA alone. Latest developments including 3D printing and artificial intelligence further advance the diagnostic value of CCTA in coronary artery disease.

Conclusion and Significance: CCTA has played an important role in the diagnostic assessment of coronary artery disease due to its reliability and high diagnostic value. It presents challenges to invasive coronary angiography due to its less invasiveness but with similar diagnostic accuracy or even better plaque characterization. Current evidence indicates that CCTA has revolutionized patient screening and management.

Biography

Zhonghua Sun is a Professor and Head of Discipline of Medical Radiation Sciences at Curtin University, Australia. His research interests include diagnostic imaging, 3D medical image visualization and processing (in particular cardiovascular CT imaging), haemodynamic analysis of cardiovascular disease and 3D printing in cardiovascular disease, and 3D printing in medicine. He has published 3 books, 13 book chapters, and over 240 refereed journal papers in medical/medical imaging journals. He is a Fellow of the Society of Cardiovascular Computed Tomography. He serves as an associate editor/academic editor for 6 journals and editorial board member for more than 30 international imaging/medical journals. Specifically, his research on 3D virtual intravascular endoscopy of aortic stent grafts and coronary plaque features has led to many publications in internationally refereed radiology and surgery journals with high citations, and his recent research on 3D printing in cardiovascular disease has also produced a number of publications.

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