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EDITORIAL COMMENT

Characterization of carotid plaques with a new CT technique

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Characterization of atherosclerotic plaques in the coronary, carotid or peripheral arteries in vivo is clinically highly relevant. In particular, identification of vulnerable plaques is of utmost importance because of the high risk to precipitate acute thrombotic occlusion [1, 2]. Several techniques are being used nowadays to define the pathology of coronary plaques such as cardiovascular magnetic resonance imaging (CMR) [3–6], intravascular ultrasound (IVUS) [7], optical coherence tomography [8], and multi-slice computed tomography (MSCT) [9–11]. The latter technique combines a number of advantages, such as noninvasiveness and rapid testing, but the downside is that patients are exposed to high levels of radiation. However, recent MSCT systems that have become available, operate at high speed thereby limiting the radiation burden. When looking at the algorithms for dose reduction, the use of ECG pulsing, a reduced tube voltage of 100 kV, and the sequential scan mode are independent predictors for a reduced dose. The effect of the sequential scan mode is largest, followed by the reduced tube voltage of 100 kV.

In the paper recently published by de Weert and colleagues [12], the human atherosclerotic carotid plaque is recorded in vivo by MSCT, and analyzed off-line to determine plaque volume and composition. Secondly, the inter-observer variability has been determined. Four patient groups were included in the study, categorized by their carotid artery stenosis grade: 0–29%, 30–49%, 50–69%, and 70–99%. By manually drawing regions of interest (ROI) the pixel intensities within a ROI were divided into three categories: lipid core <60 Hounsfield Units (HU), fibrous tissue 60–130 HU, and calcification >130 HU. Before consensus was reached with regard to the lesion length, location of bifurcation and lumen attenuation, inter-observer differences and coefficients of variation (COV) were quite high and interclass correlation coefficients (ICC) were quite low. But if consensus was reached with regard to the lesion length, location of bifurcation and lumen attenuation, inter-observer differences and COV decreased, and ICC increased, to reach values almost similar to those observed after analysis of intra-observer differences.

The problems encountered with this technique are: (1) how to differentiate between a normal arterial wall and a slightly thickened arterial wall, (2) how to outline reliably the outer border of the artery where adventitial fat should not be confused with atheromatous lipid in the plaque, and (3) how to differentiate the contrast-enhanced lumen from atherosclerotic plaque. Although the present study lacks validation with histopathological techniques, previous studies of the same group have shown a good correlation between area measurements of arteries recorded by MSCT and histology [13, 14].

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The use of MSCT for quantitative assessment of atherosclerotic lesion severity of large arteries in terms of fibrous tissue, lipid, and calcifications will contribute to the rapidly increasing popularity of examinations with MSCT.

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