Abstract: 558

Plaque volume quantification by coronary computed tomography angiography using intravascular ultrasound as reference standard: a comparison between standard vs last generation ct scan

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Topic(s):
Computed Tomography: Plaque Imaging

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Background:
Recent data suggested that plaque volume quantification appeared to be one of the most promising tool for atherosclerosis burden evaluation and prediction of future acute coronary events. However, advanced atherosclerosis analysis were often performed on highly selected patients on the basis of cardiac CT image quality. Aim of the study is to assess image quality and accuracy of plaque volume quantification performed with a whole-heart coverage CT scan when compared to 64-slice CT in a non-selected all-comers consecutive cohort of patients, using intravascular ultrasound (IVUS) as reference standard.

Methods:
The study population was identified from a registry of consecutive patients who underwent a clinically indicated CCTA and invasive coronary angiography with IVUS evaluation of coronary atherosclerotic plaque burden with an interval between the two assessments lower than 4 months. Study population was divided into two groups: those who underwent CCTA with a novel 256-s whole-heart coverage CT scanner form march 2015 and march 2016 (group 1) and those who underwent CCTA with 64-slice CT scanner form march 2014 and march 2015 (group 2). In all patients plaque volume at both CCTA and IVUS was measured. Group 1 vs. group 2 image quality (Likert score) focused on plaque volume evaluable and quantification vs. IVUS was assessed. Radiation dose was recorded.

Results:
A total of 56 patients were enrolled, 28 subjects per Group; in all patients enrolled only one plaque have been assessed by IVUS for clinical reasons. The mean age did not differ among Group 1 and 2 (66 ± 9 vs 65 ±10, Group 1 vs. Group 2, respectively, p=0.878). Mean heart rate at the time of CT scan was similar for group 1 and 2 (66.7 ± 14.2 bpm and 64.6 ± 8.7 bpm, respectively, p=0.507). Of note, an heart rate > 70 bpm was recorded in 25% of patients in group 2 (7/28) and in 35% of patients in group 1 (10/28). Image quality as assessed by mean Likert score was higher in group 1 than in group 2 (3.3±0.9 vs 2.5±1.2 respectively, p=0.006). Plaque volume was not evaluable in 2 and 7 patients in group 1 and 2, respectively (7,1% vs 25%, p=0.114). Mean absolute difference between plaque volume measured by CCTA and IVUS was lower in group 1 than in group 2 (11.7±17.3 mm3 vs 30.2±36 mm3, p=0.017). Plaque volume measured by CCTA and IVUS was significative correlated in both groups, but correlation coefficient was higher in group 1 than group 2 (r: 0.97 p<0.001 vs r: 0.62 p=0.0025, respectively). Radiation dose was significative lower in group 1 vs group 2 (3.2 ± 1.4 mSv vs 8.8 ± 3.5 mSv, respectively; p<0.001).

Conclusion:
Plaque volume quantification by CCTA is feasible and accurate when compared with IVUS. Last generation CT scanner may further improve plaque volume quantification feasibility and accuracy in a real life all-comers setting, by increasing overall image quality. Of note, a concomitant reduction in radiation dose has been obtained.
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