Step and shoot coronary CT angiography using 256-slice CT: effect of heart rate and heart rate variability on image quality.

To evaluate the effect of heart rate variability (HRV) and heart rate (HR) on intra-image "motion" and inter-image "stairstep" artefacts in step-and-shoot coronary CT angiography (CCTA) using a wide detector CT scanner. 66 patients underwent step-and-shoot CCTA using 256-slice CT. Patients were divided into two groups (Group 1: HR>=65 bpm). Motion artefacts were quantified using a 5-point-scale. Stairstep artefacts were defined by measurements of misalignment. Image noise, contrast-to-noise-ratio (CNR), signal-to-noise-ratio (SNR), and radiation dose were assessed. Mean HR was 66 ± 16.7 bpm (range: 45-125 bpm) and mean HRV was 10.7 ± 17.5 bpm. A significant correlation between HR and stairstep artefacts ($r = 0.46, p<0.001$) and motion artefacts ($r = 0.63, p<0.001$) was found. Group 2 showed significantly increased step artefacts with a mean misalignment of 1.4 mm compared to 0.4 mm in Group 1 ($p<0.001$). There was no significant effect of HRV on stairstep artefacts ($r = 0.15, p = 0.416$) and motion artefacts ($r = 0.13, p = 0.311$). No significant differences in image noise, CNR, SNR, and radiation dose were seen. Unlike CCTA using narrow CT detectors, HRV has no significant effect on motion and stairstep artefacts using a wide CT detector with high z-coverage. However, a higher HR still increases stairstep and motion artefacts.