Impact of tube angulation on radiation dose using image noise reduction technology

Authors:
M Haj Abdo¹, L Langenbrink¹, J Michaelsen¹, M Wirtz², E Altiok³, D Reimann¹, R Hoffmann¹, ¹St. Bonifatius Hospital, Cardiology - Lingen - Germany , ²RWTH University Hospital Aachen, Radiotherapy - Aachen - Germany , ³RWTH University Hospital Aachen, Cardiology - Aachen - Germany ,

Topic(s):
Coronary Angiography

Objectives:
This study sought to evaluate the impact of tube angulation on radiation dose using image noise reduction technology in a clinical setting. Image noise reduction technology has been shown to significantly reduce radiation dose in coronary angiography in particular by reduction of radiation in cine mode.

Methods:
In 500 coronary angiograms performed by the same operator the dose-area product (DAP) was determined. The DAP was determined for the cine mode as well as for the fluoroscopy mode. Furthermore, in the cine mode, the DAP on a per image (DAP/frame) basis was determined for the posterior-anterior projection (PA) as well as a left anterior oblique (LAO) cranial (LAO 20°/20°) and caudal (LAO 45°/-20°), right anterior oblique (RAO) cranial (RAO 20°/20°) and caudal (RAO 30°/-20°) angulations. The image intensifier area was kept constant for all angulations.

Results:
Mean body mass index was 28.6±5.5 kg/m². Mean total DAP was 1227±1417 cGycm². The mean ratio of DAP in cine mode/DAP in fluoro mode was 0.54±0.32. Mean DAP/frame in PA angulation was 5.5±3.3 (cGycm²). Considering the cine mode, for the LAO cranial and LAO caudal angulations, the relative DAP/frame compared to the PA angulation was 2.8±1.8 and 4.2±1.6, respectively. For the RAO cranial and RAO caudal angulations, the relative DAP/frame compared to the PA angulation was 1.7±2.2 and 1.8±1.4.

Conclusions:
Using image noise reduction technology, radiation during fluoroscopy mode contributes more to total radiation dose than radiation during cine mode. In cine mode, the PA angulation has least radiation/frame. The LAO caudal angulation is associated with greatest increase in radiation dose compared to the PA angulation, while LAO cranial angulation and RAO cranial and caudal angulations increase radiation dose to a lesser extent.