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Institutionen för klinisk vetenskap, intervention och teknik (CLINTEC), Enheten för radiografi

Intravenous Contrast Media Optimization at Computed Tomography

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ABSTRACT

The administration of intravenous contrast media (IV CM) is essential for detecting lesions at most computed tomography (CT) examinations. The overall aim of this thesis is to investigate different aspects of IV CM administration that may affect the quality
of the CT examination.

In **Study I** a comparison was made between a low-osmolar contrast media (LOCM) iomeprol and the iso-osmolar contrast medium (IOCM) iodixanol, focusing on how
they affect heart rate (HR), influence patient heat sensation and image quality during coronary computed angiography (CCTA). No significant difference in terms of HR interfering with the imaging protocol was observed. However, there was a larger number of arrhythmic heart beats (HB) observed when using LOCM in comparison to IOCM ($p < 0.001$). There was no statistically significant difference in image quality between the two CM. The experienced heat sensation was significantly stronger with LOCM in comparison to IOCM (visual analogue scale = 36 mm and 18 mm respectively, $p< 0.05$).

In **Study II** the variation in IV CM enhancement in Hounsfield units (HU) in the liver and the aorta in relation to different expressions of body size was studied using two different CM (LOCM iomeprol and IOCM iodixanol). A significant relationship was observed for all studied body size parameters. Three parameters had a stronger correlation to the CM enhancement; Body weight (BW, r= -0.51 and -0.64), body surface area (BSA, r= -0.54 and -0.65) and lean body mass (LBM, r= -0.54 and -0.59), but there was no statistically significant difference between those. Body height (BH), body mass index (BMI) and ideal body weight (IBW) had weaker correlations to CM enhancement of the liver and the aorta. When adjusting for differences in weight, height, age and sex between the two groups there was a significantly stronger liver enhancement with iodixanol than with iomeprol (mean difference 6 HU, $p < 0.01$).

In **Study III** the correlation between liver CM enhancement and volume pitch-corrected computed tomographic dose index ($CTDI_{vol}$) and BW was studied. Liver enhancement was negatively correlated to both $CTDI_{vol}$
($r = -0.60$) and BW ($r = -0.64$).

In **Study IV** the relationship between arm positioning, BW and cardiac output (CO) versus CM-enhancement /timing during CCTA was studied. Patients were randomized into two groups. Group A (n=50) was positioned with arms resting on a pillow above their head and Group B (n=50) with their arms resting on the front panel of the CT. Statistically significant more patients in group A compared with group B (26 versus 14) showed a higher attenuation of the left atrium in comparison to the ascending aorta indicating too early scanning after IV CM injection ($p=<0.05$). In both groups BW and CO were statistically significantly related to the attenuation of ascending aorta ($p<0.01$).

Conclusion: The iso-osmolar contrast medium iodixanol causes less arrhythmic HB and less heat sensation than the low-osmolar contrast medium iomeprol, but this does not significantly influence the quality at CCTA. The positioning of the arms affects contrast media timing at CCTA. CM enhancement of the liver and aorta is affected by body size. Several parameters can be used to adjust CM dose, but none is statistically significantly better parameter than BW. However, $CTDI_{vol}$ can potentially replace BW when adjusting CM dose for body size. This would make it potentially feasible to individualize CM dosage automatically by the CT scanner.