



Comparing Ultrahigh-Resolution Acquisition Modes In Photon-Counting Detector CT Angiography With A Dedicated Ex Vivo Model

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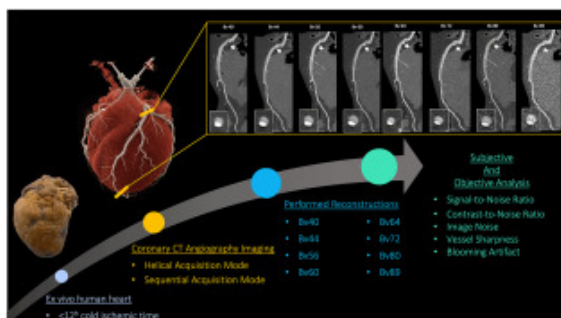
Introduction: We aimed to investigate the feasibility of the helical and sequential ultra-high-resolution (UHR) coronary CT angiography (CCTA) scan modes directly with photon-counting detector CT (PCD-CT) in an *ex vivo* study. Furthermore, we aimed to optimize image reconstruction parameters in case of high coronary calcium load.

Methods: CCTA imaging in helical and sequential UHR scan modes was repeated on *ex vivo* human hearts. Eight different vascular kernels were used for reconstruction (Bv40, Bv44, Bv56, Bv60, Bv64, Bv72, Bv80 and Bv89) with matrix sizes of 512x512 and 1024x1024. Image noise (IN), signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR), vessel sharpness (VS) and blooming artifact were quantified. Subjective image quality (IQ), IN, VS was assessed by five independent, blinded reader using four-point discrete scales.

Results: 5 *ex vivo* hearts were included. Softer kernels showed the lowest IN, VS and highest SNR and CNR values in both acquisition modes ($IN_{Bv40hel}$: $30,6 \pm 7,3$ HU; $SNR_{Bv40hel}$: $12 \pm 6,9$ HU; $CNR_{Bv40hel}$: $16,2 \pm 8,4$ HU; $VS_{Bv40hel}$: $421,7 \pm 72,4$ Δ HU/mm versus $IN_{Bv40seq}$: $26,7 \pm 11,8$ HU; $SNR_{Bv40seq}$: $15,5 \pm 3,7$ HU; $CNR_{Bv40seq}$: $17,1 \pm 6,2$ HU; $VS_{Bv40seq}$: $443,3 \pm 22,6$ Δ HU/mm). Lowest SNR and CNR were observed for both helical and sequential acquisition modes with the sharpest kernel Bv89 ($2,4 \pm 0,5$ and $3,1 \pm 0,6$ respectively) coinciding with highest IN ($167,1 \pm 24,6$ HU). Comparing objective parameters between helical and sequential acquisition modes, there was no significant difference for any kernel (all

$p > 0.05$ unadjusted). Blooming artifacts reduced towards Bv64_{seq} and Bv72_{hel} ($35,2 \pm 10,2\%$ versus $33,7 \pm 8,4\%$). In sequential mode IQ and subjective IN were rated excellent for kernels Bv44, Bv56, Bv60 and Bv64 (median 4, IQR 3–4) while in helical mode IQ and subjective IN were excellent for kernels Bv40 up to Bv60 (median 4, IQR 3–4). Image sharpness was best with kernels Bv80, Bv72, Bv64 and Bv60 (median 4, IQR 4–4 and median 3, IQR 3–4 respectively).

Conclusions: UHR helical and sequential image acquisition modes of a PCD-CT do not differ significantly in IQ. Optimal IQ and vessel delineation was achieved when using vascular kernel Bv64 with matrix size of 512x512, as it had similar SNR and CNR compared to kernels Bv40 and Bv44, but exhibited better visualization of vessel sharpness.



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