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Dark-Blood T1 SAPHIRE mapping gives cleaner myocardial signal at both 1.5T and 3T

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Background: Partial-voluming effects at the myocardial-blood interface may falsely increase myocardial T1 mapping times.

Purpose: We hypothesize that dark-blood (DB) native myocardial T1 times by SAPHIRE (modified Saturation Pulse Prepared Heart-rate independent Inversion Recovery) have significantly less myocardial signal contamination from blood in comparison to conventional bright-blood T1 mapping at 1.5T and 3T.

Methods: Same-day CMR was prospectively performed on 10 healthy volunteers (36.2 ± 10.0 years, 20% males) at 1.5T and 3T (Aera/Prisma, Siemens) using both conventional and DB SAPHIRE. Mean T1 times per slice (basal, mid and apical short-axis) and global values were measured. Endocardial and epicardial borders were manually drawn with a 10% offset. Normal ranges were defined as mean \pm 2 standard deviations. Mean values are presented.

Results: Normal ranges at 1.5T were 1228-1383ms for conventional SAPHIRE and 1180-1302ms for DB SAPHIRE. T1 times were significantly lower by DB vs conventional SAPHIRE in global myocardial assessment. (1241 vs 1305ms, $p = 0.005$). No significant in the basal (1229 vs 1281ms, $p = 0.075$) or mid slices (1245 vs 1270ms, $p = 0.263$), but apical slices had lower T1 values using DB SAPHIRE (1246 vs 1348ms, $p = 0.043$).

Normal ranges at 3T were 1557-1731ms for conventional SAPHIRE and 1524-1666ms for DB SAPHIRE. Global myocardial T1 times were significantly lower by DB vs conventional SAPHIRE (1595 vs 1644ms, $p = 0.015$) but not in slice-specific reads (basal: 1598 vs 1639ms, $p = 0.138$; mid: 1598 vs 1598ms, $p = 0.612$; apical: 1608 vs 1666ms, $p = 0.109$). The myocardial signal intensity range in DB SAPHIRE was smaller vs conventional SAPHIRE (Figure).

Conclusion: Black-blood SAPHIRE T1 mapping significantly reduces myocardial signal contamination from blood at both 1.5 and 3T and may have value in the deep-phenotyping of thin-walled hearts.

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Figure. Signal intensity in the mid septum at 3T on patient #8 showed a higher range of signal values for the conventional SAPHIRE vs DB SAPHIRE (in this case, range of values was 529ms for conventional T1 vs 210ms for DB T1).

