

Figure S1 Dynamic visualization of diaphragmatic dome motion throughout a respiratory cycle. The series of images acquired by bSSFP captures the upward and downward trajectories of the diaphragmatic dome as it transitions from (B,C) to (A,D) exhalation. The distance spanned between the red and white dashed lines delineates the extent of the diaphragmatic dome's excursion.

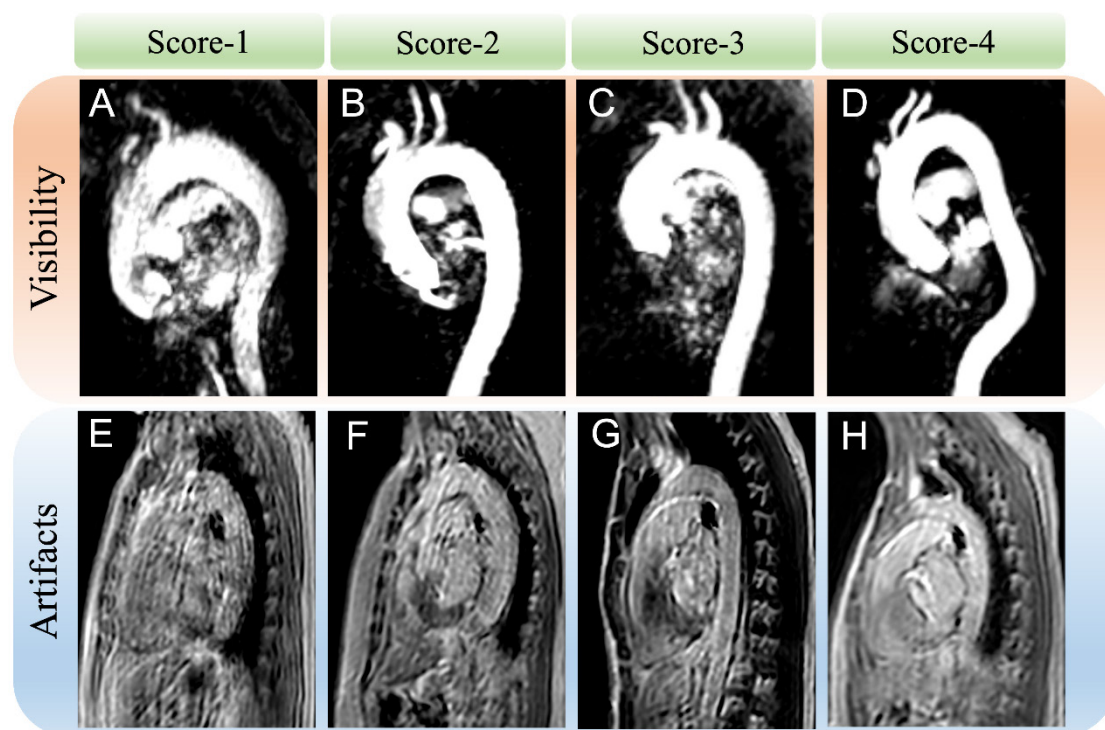


Figure S2 Illustrative examples of image quality assessment criteria. The uppermost row of the matrix displays the scoring grades, and the extreme left column enumerates the specific scoring items. Panels (A-D) illustrate varying levels of image visibility, whereas panels (E-H) depict the presence and severity of artifacts.

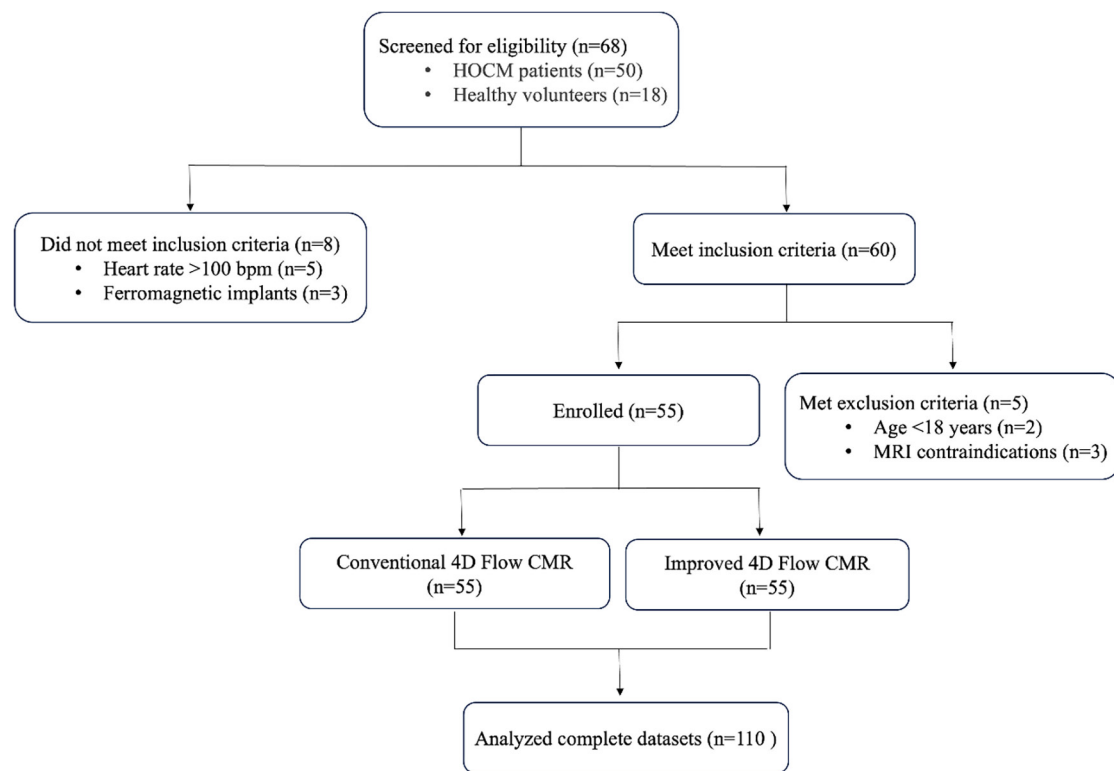


Figure S3 Participant flowchart. Detailed description of screening, exclusion and final participation.

Table S1 The proportion of comparisons between conventional and improved 4D Flow CMR for the image quality

Image quality	Conventional>Improved	Conventional<Improved	Conventional=Improved
Visibility	2 (3.64)	6 (10.91)	47 (85.45)
Artifacts	3 (5.45)	33 (60)	19 (34.55)

Fifty-five study subjects. Statistical analysis using Wilcoxon rank sum test. Data in parentheses are percentage. CMR, cardiac magnetic resonance.

Table S2 Intra-observer and inter-observer reproducibility analysis of conventional and improved 4D Flow CMR

Variables	Conventional						Improved					
	Intra-observer reproducibility			Inter-observer reproducibility			Intra-observer reproducibility			Inter-observer reproducibility		
	ICC	95% CI	P	ICC	95% CI	P	ICC	95% CI	P	ICC	95% CI	P
Navigation offset	0.966	0.993-0.998	<0.001	0.994	0.990-0.997	<0.001	0.983	0.971-0.990	<0.001	0.986	0.976-0.992	<0.001
aSNR	0.972	0.953-0.984	<0.001	0.955	0.925-0.974	<0.001	0.945	0.908-0.967	<0.001	0.94	0.893-0.966	<0.001
Visibility	0.886	0.812-0.932	<0.001	0.882	0.807-0.930	<0.001	0.916	0.859-0.950	<0.001	0.916	0.859-0.950	<0.001
Artifacts	0.939	0.898-0.964	<0.001	0.939	0.898-0.964	<0.001	0.893	0.824-0.936	<0.001	0.947	0.910-0.969	<0.001
AAo												
V _{peak}	0.986	0.977-0.992	<0.001	0.943	0.905-0.966	<0.001	0.989	0.980-0.994	<0.001	0.959	0.929-0.976	<0.001
P _{max}	0.986	0.975-0.992	<0.001	0.967	0.945-0.981	<0.001	0.986	0.975-0.992	<0.001	0.98	0.963-0.989	<0.001
V	0.994	0.990-0.996	<0.001	0.932	0.830-0.939	<0.001	0.991	0.985-0.995	<0.001	0.937	0.894-0.963	<0.001
Arch												
V _{peak}	0.987	0.978-0.993	<0.001	0.945	0.908-0.968	<0.001	0.979	0.964-0.988	<0.001	0.905	0.842-0.943	<0.001
P _{max}	0.984	0.972-0.990	<0.001	0.967	0.944-0.981	<0.001	0.978	0.962-0.987	<0.001	0.94	0.900-0.965	<0.001
V	0.978	0.962-0.987	<0.001	0.932	0.886-0.960	<0.001	0.934	0.886-0.962	<0.001	0.928	0.881-0.958	<0.001
DAo												
V _{peak}	0.991	0.985-0.995	<0.001	0.948	0.912-0.969	<0.001	0.985	0.974-0.991	<0.001	0.847	0.753-0.908	<0.001
P _{max}	0.99	0.984-0.994	<0.001	0.98	0.966-0.988	<0.001	0.988	0.979-0.993	<0.001	0.951	0.918-0.971	<0.001
V	0.988	0.980-0.993	<0.001	0.937	0.894-0.963	<0.001	0.987	0.979-0.993	<0.001	0.876	0.783-0.929	<0.001

CMR, cardiac magnetic resonance; ICC, intraclass correlation coefficient; CI, confidence interval; aSNR, apparent signal-to-noise ratio.