

Supplementary Table S1. The specific parameters of structural multiparametric MRI

MRI Sequence	TCIA	Dataset	
		Institution 1	Institution 2
T1CE	TR/TE, 4.9–3285 ms/2.1–20 ms; slice thickness, 1–5 mm; spacing slice, 0.6–7.5 mm	TR/TE, 7.98 ms/2.57 ms; FOV, 220 x 220 mm; matrix, 512 x 512; slice thickness, 1 mm	TR/TE, 6.82 ms/2.16 ms; FOV, 320 x 320 mm; matrix, 512 x 512; slice thickness, 1.6 mm
T1WI	TR/TE, 352–3379 ms/2.75–19 ms; slice thickness, 1–5 mm; spacing slice, 2–7.5 mm.	TR/TE, 5.98 ms/1.83 ms; FOV, 220 x 220 mm; matrix, 512 x 512; slice thickness, 1.6 mm	TR/TE, 680 ms/7.63 ms; FOV, 320 x 320 mm; matrix, 512 x 512; slice thickness, 5 mm
T2WI	TR/TE, 700–6370 ms/15–120 ms; slice thickness, 1.5–5 mm; spacing slice, 1.5–7.5 mm	TR/TE, 5220 ms/96.12 ms; FOV, 220 x 220 mm; matrix, 512 x 512; slice thickness, 5 mm.	TR/TE, 4322 ms/124.25 ms; FOV, 256 x 256 mm; matrix, 512 x 512; slice thickness, 4.4 mm
FLAIR	TR/TE, 6000–11,000 ms/34.6–155 ms; slice thickness, 2.5–5 mm; spacing slice, 2–7.5 mm. The matrix size of all the MRI sequences was either 256 x 256 or 512 x 512.	TR/TE, 11000 ms/142.43 ms; FOV, 220 x 220 mm; matrix, 512 x 512; slice thickness, 4 mm	FLAIR : TR/TE, 9350 ms/142.56 ms; FOV, 320 x 224 mm; matrix, 512 x 512; slice thickness, 4 mm

TCIA = The Cancer Image Archive, T1WI = T1-weighted image, T1CE = contrast-enhanced T1WI, T2WI= T2-weighted image, FLAIR = Fluid-attenuated inversion recovery, TR = repetition time, TE= echo time, FOV = field of view.

Supplementary Table S2. Radiomic features description	
Feature Family	Specific Features
Intensity Features (First-Order Statistics)	Minimum Maximum Mean Standard Deviation Variance Skewness Kurtosis
Histogram -based	Bin Frequency
Volumetric	Volume/ Area
Morphologic	Elongation Perimeter Roundness Eccentricity Ellipse Diameter Equivalent Spherical Radius
Grey Level Co-occurrence Matrix (GLCM)	Energy (Angular Second Moment) Contrast (Inertia) Joint Entropy Homogeneity (Inverse Difference Moment) Correlation Variance SumAverage Auto Correlation
Grey Level Run-Length Matrix (GLRLM)	SRE LRE GLN RLN LGRE HGRE SRLGE SRHGE LRLGE LRHGE
Neighborhood Grey-Tone Difference Matrix (NGTDM)	Coarseness Contrast Busyness Complexity Strength
Grey Level Size-Zone Matrix (GLSZM)	SZE LZE GLN ZSN ZP LGZE HGZE SZLGE SZHGE LZLGE

	LZHGE
	GLV
	ZLV
Lattice -based	Selected features
	Feature Maps

Supplementary Table S3. Hyperparameters of machine learning classifiers used in this study.

Classifier	Hyperparameters
SVM	Cost = 1.0; Regression loss epsilon = 0.10; Kernel = linear; Numerical tolerance = 0.0010; Iteration limit = 100
kNN	Number of neighbors = 5; Metric = Euclidean; Weight = uniform
Random Forest	Number of trees = 5; Replicable training = yes; Attributes at each split = 5; Limit depth of individual trees = 3.
Logistic regression	Regularization type = LASSO (L1)
Naïve Bayes	Type = Gaussian, Priors = None; Variable smoothing = 1e-9
Neural Network	Neurons in hidden layers = 100; Activation = ReLu; Solver = Adam; Regularization alpha = 0.001; Maximal number of iterations = 200; Replicable training = yes.

SVM = Support Vector Machine, kNN = k-Nearest Neighbor, LASSO = Least Absolute Shrinkage and Selection Operator.

Supplementary Table S4. Model performance grouped by feature selection filter and machine learning classifier on training dataset

Classifier	Filter	AUC	CA	Precision	F1
Naive Bayes	Information Gain	0.884	0.818	0.883	0.837
	Gini Index	0.886	0.825	0.877	0.842
	FCBF	0.885	0.804	0.879	0.826
k-Nearest Neighbor	Information Gain	0.925	0.902	0.902	0.886
	Gini Index	0.929	0.895	0.895	0.876
	FCBF	0.904	0.902	0.895	0.893
Neural Network	Information Gain	0.906	0.902	0.912	0.882
	Gini Index	0.911	0.909	0.918	0.892
	FCBF	0.894	0.902	0.897	0.890
Random Forest	Information Gain	0.978	0.944	0.948	0.939
	Gini Index	0.985	0.972	0.973	0.971
	FCBF	0.983	0.937	0.937	0.932
Support Vector Machine	Information Gain	0.802	0.853	0.828	0.803
	Gini Index	0.817	0.867	0.885	0.821
	FCBF	0.842	0.860	0.846	0.817
Logistic Regression	Information Gain	0.823	0.839	0.715	0.772
	Gini Index	0.823	0.846	0.797	0.788
	FCBF	0.853	0.839	0.715	0.772

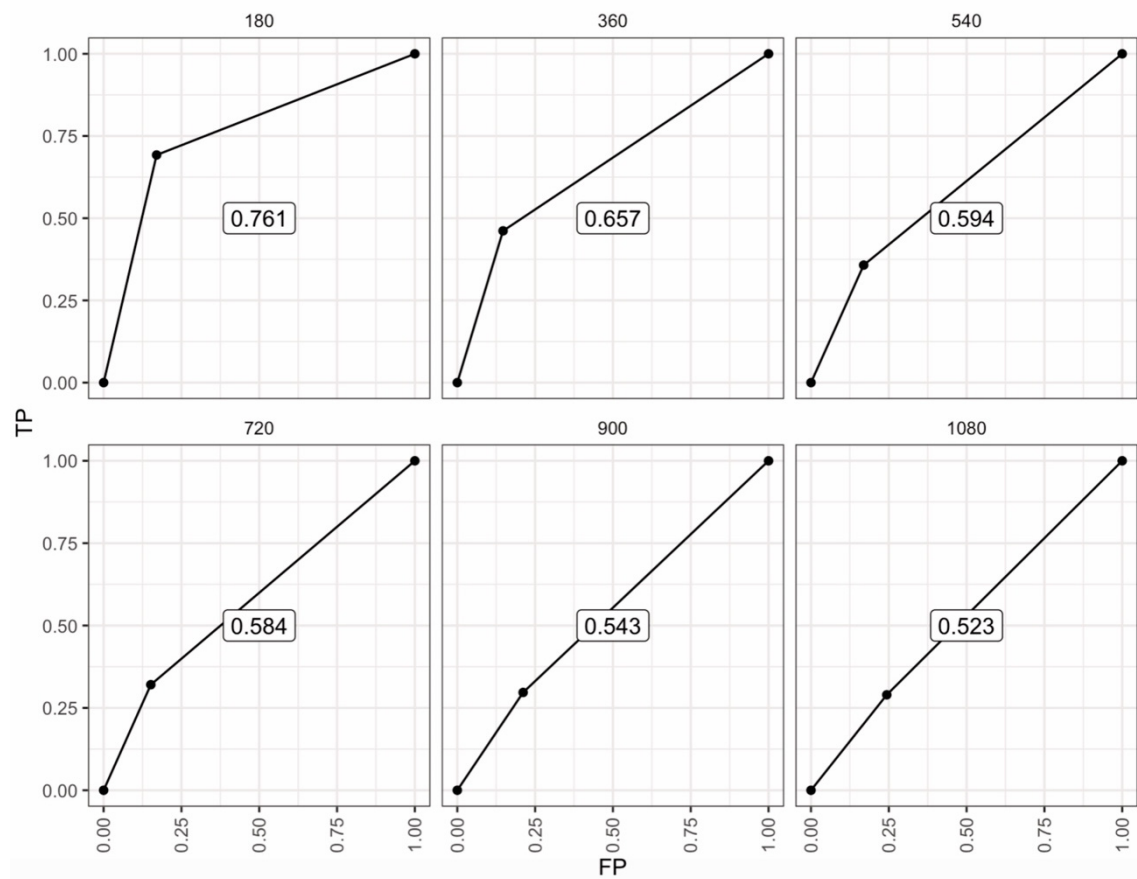
AUC: area under the curve; CA: classification accuracy; FCBC: fast correlation based filter.

Supplementary Table S5. Kaplan-Meier analysis based on Random Forest Survival risk groups

Sample	OOB-CHF Cutpoint	Risk groups and number of cases	Median OS (IQR) days	Log-rank Test	
				χ^2	p
Training dataset	0.6836856	Low = 86	466 (283)	19.9	< .001
		High = 57	331 (236)		
Testing dataset	0.6836856	Low = 43	486 (314)	7	.008
		High = 17	155 (236)		

OS= Overall survival. IQR= interquartile range, OOB-CHF = out of bag cumulative hazard function.

Supplementary Table S6. Methodologic quality evaluation of our study by the Radiomic Quality Score	
Scoring item	Points
Image protocol quality	1
Multiple segmentations	1
Phantom study on all scanners	0
Imaging at multiple time points	0
Feature reduction or adjustment for multiple testing	3
Multivariate analysis with nonradiomic features	1
Detect and discuss biologic correlates	0
Cutoff analysis	1
Discrimination statistics	2
Calibration statistics	1
Prospective study registered in trial data base	0
Validation	5
Comparison with criterion standard	0
Potential clinical utility	2
Cost-effectiveness analysis	0
Open science and data	2
Total points	19/36 (53 %)



Supplementary Figure S1. Time-dependent receiver operating characteristics (ROC) curve of the Random Survival Forest survival model in the testing data set. Time in days appears at the top of each panel. TP = true positives, FP = False positives.