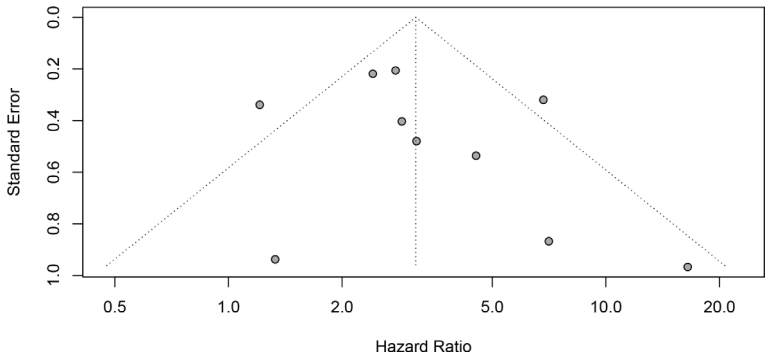

Figure S1 Funnel plot of studies included for DFS in the meta-analysis. Funnel plot with pseudo 95% confidence limits for assessment of publication bias included in the meta-analysis. The Egger's test revealed that the likelihood of publication bias was low (P=0.398). DFS, disease-free survival.

https://dx.doi.org/10.21037/qims-23-692

Table S1 Study search strategy

1.1 Cochrane search strategy

Available via https://www.cochrane.org/

No.	Query	Results
#1	Rectal Neoplasms	3,113
#2	(Rectal Neoplasm): ab,ti,kw OR (Rectum Neoplasm): ab,ti,kw OR (Rectal Tumor): ab,ti,kw OR (Rectal Cancer): ab,ti,kw OR (Rectum Cancer):ab,ti,kw OR (rectal malignancy): ab,ti,kw OR (rectum malignancy): ab,ti,kw	7,497
#3	#1 OR #2	7,978
#4	(radiomics): ab,ti,kw OR (radiomic): ab,ti,kw OR (texture): ab,ti,kw	2,046
#5	(prognosis): ab,ti,kw OR (survival): ab,ti,kw	140,645
#6	#3 AND #4 AND #5 with Cochrane Library publication date Between Jan 2012 and Jun 2022, in Trials	4

1.2 Embase search strategy

Available via www.embase.com

No.	Query	Results
#1	'rectal neoplasms'/exp OR 'rectal neoplasms'	112,653
#2	'rectal neoplasm': ab,ti OR 'rectum neoplasm': ab,ti OR 'rectal tumor':ab,ti OR 'rectal cancer': ab,ti OR 'rectum cancer':ab,ti OR 'rectal malignancy':ab,ti OR 'rectum malignancy': ab,ti	43,746
#3	#1 OR #2	117,719
#4	'radiomics': ab,ti OR 'radiomic': ab,ti OR 'texture':ab,ti	47,524
#5	'prognosis': ab,ti OR 'survival':ab,ti	2,090,192
#6	#3 AND #4 AND #5	96
#7	#3 AND #4 AND #5 AND [01-01-2012]/sd NOT [01-07-2022]/sd	87

1.3 Medline search strategy

Available via https://pubmed.ncbi.nlm.nih.gov

No.	Query	Results
#1	Rectal Neoplasms	70,789
#2	((((((Rectal Neoplasm) OR (Rectum Neoplasm)) OR (Rectal Tumor)) OR (Rectal Cancer)) OR (Rectum Cancer)) OR (rectal malignancy)) OR (rectum malignancy)	97,528
#3	(Rectal Neoplasms) OR (((((((Rectal Neoplasm) OR (Rectum Neoplasm)) OR (Rectal Tumor)) OR (Rectal Cancer)) OR (Rectum Cancer)) OR (rectal malignancy)) OR (rectum malignancy))	97,528
#4	((radiomics) OR (radiomic)) OR (texture)	54,132
#5	(Prognosis) OR (Survival)	3,871,427
#6	("2012/1/1"[Date - Publication]: "2022/6/30"[Date - Publication])	12,686,164
#7	((((Rectal Neoplasms) OR (((((((Rectal Neoplasm) OR (Rectum Neoplasm)) OR (Rectal Tumor)) OR (Rectal Cancer)) OR (Rectum Cancer)) OR (rectal malignancy)) OR (rectum malignancy))) AND (((radiomics) OR (radiomic)) OR (texture))) AND ((Prognosis) OR (Survival))) AND (("2012/1/1"[Date - Publication]: "2022/6/30"[Date - Publication]))	127

1.4 Web of Science search strategy

Available via https://www.webofscience.com/wos/diidw/basic-search

No.	Query	Results
#1	TS= (Rectal Neoplasms OR Rectal Neoplasm OR Rectum Neoplasm OR Rectal Tumor OR Rectal Cancer OR Rectum Cancer OR rectal malignancy OR rectum malignancy)	67,331
#2	TS= (radiomics OR radiomic OR texture)	696,382
#3	TS= (Prognosis OR Survival)	3,025,915
#4	#1 AND #2 AND #3	140

https://dx.doi.org/10.21037/qims-23-692

Table S2 Pre-processing steps according to IBSI guideline

IBSI#	Pre-processing performed	Explanation
46	**Intensity normalization**—describe the method and settings used to normalize intensity distributions within a patient or patient cohort	Any kind of normalization method was accepted, such as white stripe normalization, z-score normalization, or normalization using the $\mu \pm 3\sigma$ method
48	**Segmentation method**—describe how regions of interest were segmented; describe the number of experts, their expertise and consensus strategies for manual delineation; describe methods and settings used for semi-automatic and fully automatic segmentation; describe which image was used to define segmentation in case of multi-modality imaging	Any kind of segmentation method was accepted, such as manual segmentation, semi-automatic segmentation, or fully automatic segmentation, with or without providing number of experts, their expertise and consensus strategies for manual delineation, or settings used for semi-automatic or fully automatic segmentation
50	**Image interpolation**—describe which interpolation algorithm was used to interpolate the image; describe how the position of the interpolation grid was defined; describe how the dimensions of the interpolation grid were defined; describe how extrapolation beyond the original image was handled	Mentioning the exact term "interpolation" or "resampling" was presumed to perform iso-voxel resampling with or without providing interpolation algorithm, the position of the interpolation grid, or how extrapolation beyond the original image was handled
56	**Grey-level discretization**—describe the method used to discretize image intensities	Mentioning the exact term "discretization" was presumed to perform gray-level discretization with or without providing the number of bins or the size of the bins
57	**Image filter**—describe whether and which methods and settings were used to filter images	Any kind of filtering method was accepted, such as Laplacian-of-Gaussian, wavelet, or a declaration of non-filtering
59	**IBSI compliance**—state if the software used to extract the set of image biomarkers is able to reproduce the IBSI feature reference values	A software is compliant if and only if it is able to reproduce image biomarker reference values for the digital phantom and for one or more image processing configurations using the radiomics CT phantom. We documented the name of software, and then found out whether they were IBSI compliant or not
60	**Robustness**—describe how robustness of the image biomarkers was assessed	Robustness is one of the key concerns for generalizability and application of radiomics models. We documented the method of robustness assessment, e.g., test-retest analysis, before the model building

IBSI, Image Biomarkers Standardization Initiative; CT, computed tomography.

https://dx.doi.org/10.21037/qims-23-692

Table S3 RQS rating per study

Study	Meng, 2018 (1)	Wang, 2019 (2)	Cui, 2021 (3)	Tibermacine, 2021 (4)	Chiloiro, 2022 (5)	Zhou, 2022 (6)	Cui, 2022 (7)	Nie, 2022 (8)	Wang, 2022 (9)	Meng, 2018 (10)	Bang, 2015 (11)	Chee, 2017 (12)	Jali, 2016 (13)	Lovinfosse, 2017 (14)	Hotta, 2021 (15)
Total 16 items (ideal score 36)	11	10	12	11	2	13	14	13	8	8	2	2	3	3	4
Domain 1: protocol quality and stability in image and segmentation (0 to 5 points)	2	2	1	2	2	2	2	2	2	1	1	2	1	1	2
1. Protocol quality (2 points)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2. Multiple segmentations (1 point)	1	1	0	1	0	1	1	1	0	0	0	1	0	0	1
3. Phantom study (1 point)	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
4. Imaging at multiple time points (1 point)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Domain 2: feature selection and validation (–8 to 8 points)	5	5	5	6	-2	5	5	5	-2	5	-2	-2	-2	-2	-2
5. Feature reduction or adjustment of multiple testing (–3 or 3 points)	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
6. Validation (-5, 2, 3, 4, or 5 points)	2	2	2	3	-5	2	2	2	-5	2	-5	-5	-5	-5	-5
Domain 3: biologic/clinical validation and utility (0 to 6 points)	1	1	3	1	1	3	3	3	4	0	3	1	3	3	3
7. Non-radiomics features (1 point)	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1
8. Biologic correlations (1 point)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9. Comparison to “gold standard” (2 points)	0	0	0	0	0	0	0	2	2	0	2	0	2	2	2
10. Potential clinical utility (2 points)	0	0	2	0	0	2	2	0	2	0	0	0	0	0	0
Domain 4: model performance index (0 to 5 points)	3	2	3	1	1	3	4	3	3	2	0	1	1	1	1
11. Cut-off analysis (1 point)	1	0	1	0	0	1	1	1	1	1	0	1	1	1	1
12. Discrimination statistics (2 points)	2	2	1	1	1	1	1	1	2	1	0	0	0	0	0
13. Calibration statistics (2 points)	0	0	1	0	0	1	2	1	0	0	0	0	0	0	0
Domain 5: high level of evidence (0 to 8 points)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14. Prospective study (7 points)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15. Cost-effectiveness analysis (1 point)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Domain 6: Open science and data (0 to 4 points)	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0
16. Open science and data (0 to 4 points)	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0

RQS, radiomics quality score.

https://dx.doi.org/10.21037/qims-23-692

Table S4 PROBAST assessment for each study

Study	Risk of bias				Applicability			Overall	
	Participants	Predictors	Outcome	Analysis	Participants	Predictors	Outcome	Risk of bias	Applicability
Meng, 2018 (1)	+	+	+	–	+	+	+	–	+
Wang, 2019 (2)	+	+	+	–	+	+	+	–	+
Cui, 2021 (3)	+	+	+	–	+	+	+	–	+
Tibermacine, 2021 (4)	+	+	?	–	+	+	?	?	?
Chiloiro, 2022 (5)	+	+	+	–	+	+	+	–	+
Chuanji, 2022 (6)	+	+	+	?	+	+	+	–	+
Cui, 2022 (7)	+	–	?	–	+	+	+	?	+
Nie, 2022 (8)	+	?	+	–	+	+	+	?	+
Wang, 2022 (9)	?	+	?	–	+	+	+	?	+
Meng, 2018 (10)	+	?	+	–	+	+	+	?	+
Bang, 2015 (11)	–	+	–	–	+	+	+	–	+
Chee, 2017 (12)	–	?	+	–	+	?	+	?	?
Jalil, 2016 (13)	–	–	+	–	+	?	+	–	?
Lovinfosse, 2018 (14)	–	+	+	–	+	+	+	–	+
Hotta, 2021 (15)	+	+	+	–	+	+	+	–	+

+, low; –, high; ?, unclear. PROBAST, Prediction Model Risk of Bias Assessment Tool.

https://dx.doi.org/10.21037/qims-23-692

References

1. Meng Y, Zhang Y, Dong D, Li C, Liang X, Zhang C, Wan L, Zhao X, Xu K, Zhou C, Tian J, Zhang H. Novel radiomic signature as a prognostic biomarker for locally advanced rectal cancer. J Magn Reson Imaging 2018. [Epub ahead of print]. doi: 10.1002/jmri.25968.
2. Wang J, Shen L, Zhong H, Zhou Z, Hu P, Gan J, Luo R, Hu W, Zhang Z. Radiomics features on radiotherapy treatment planning CT can predict patient survival in locally advanced rectal cancer patients. Sci Rep 2019;9:15346.
3. Cui Y, Yang W, Ren J, Li D, Du X, Zhang J, Yang X. Prognostic value of multiparametric MRI-based radiomics model: Potential role for chemotherapeutic benefits in locally advanced rectal cancer. Radiother Oncol 2021;154:161-9.
4. Tibermacine H, Rouanet P, Sbarra M, Forghani R, Reinhold C, Nougaret S; . Radiomics modelling in rectal cancer to predict disease-free survival: evaluation of different approaches. Br J Surg 2021;108:1243-50.
5. Chiloiro G, Boldrini L, Preziosi F, Cusumano D, Yadav P, Romano A, Placidi L, Lenkowicz J, Dinapoli N, Bassetti MF, Gambacorta MA, Valentini V. A Predictive Model of 2yDFS During MR-Guided RT Neoadjuvant Chemoradiotherapy in Locally Advanced Rectal Cancer Patients. Front Oncol 2022;12:831712.
6. Chuanji Z, Zheng W, Shaolv L, Linghou M, Yixin L, Xinhui L, Ling L, Yunjing T, Shilai Z, Shaozhou M, Boyang Z. Comparative study of radiomics, tumor morphology, and clinicopathological factors in predicting overall survival of patients with rectal cancer before surgery. Transl Oncol 2022;18:101352.
7. Cui Y, Wang G, Ren J, Hou L, Li D, Wen Q, Xi Y, Yang X. Radiomics Features at Multiparametric MRI Predict Disease-Free Survival in Patients With Locally Advanced Rectal Cancer. Acad Radiol 2022;29:e128-38.
8. Nie K, Hu P, Zheng J, Zhang Y, Yang P, Jabbour SK, Yue N, Dong X, Xu S, Shen B, Niu T, Hu X, Cai X, Sun J. Incremental Value of Radiomics in 5-Year Overall Survival Prediction for Stage II-III Rectal Cancer. Front Oncol 2022;12:779030.
9. Wang F, Tan BF, Poh SS, Siow TR, Lim FLWT, Yip CSP, Wang MLC, Nei W, Tan HQ. Predicting outcomes for locally advanced rectal cancer treated with neoadjuvant chemoradiation with CT-based radiomics. Sci Rep 2022;12:6167.
10. Meng Y, Zhang Y, Zhang C, Wan L, Zhang H, Dong D, Zhao X, Xu K, Li C, Zhou C. To compare the predictive value of the radiomics signature extrated from MRI plain or enhancement imaging for the survival of rectal cancer. Chinese Journal of Radiology 2018;52:349-55.
11. Bang JI, Ha S, Kang SB, Lee KW, Lee HS, Kim JS, Oh HK, Lee HY, Kim SE. Prediction of neoadjuvant radiation chemotherapy response and survival using pretreatment [(18)F]FDG PET/CT scans in locally advanced rectal cancer. Eur J Nucl Med Mol Imaging 2016;43:422-31.
12. Chee CG, Kim YH, Lee KH, Lee YJ, Park JH, Lee HS, Ahn S, Kim B. CT texture analysis in patients with locally advanced rectal cancer treated with neoadjuvant chemoradiotherapy: A potential imaging biomarker for treatment response and prognosis. PLoS One 2017;12:e0182883.
13. Jalil O, Afaq A, Ganeshan B, Patel UB, Boone D, Endozo R, Groves A, Sizer B, Arulampalam T. Magnetic resonance based texture parameters as potential imaging biomarkers for predicting long-term survival in locally advanced rectal cancer treated by chemoradiotherapy. Colorectal Dis 2017;19:349-62.
14. Lovinfosse P, Polus M, Van Daele D, Martinive P, Daenen F, Hatt M, Visvikis D, Koopmansch B, Lambert F, Coimbra C, Seidel L, Albert A, Delvenne P, Hustinx R. FDG PET/CT radiomics for predicting the outcome of locally advanced rectal cancer. Eur J Nucl Med Mol Imaging 2018;45:365-75.
15. Hotta M, Minamimoto R, Gohda Y, Miwa K, Otani K, Kiyomatsu T, Yano H. Prognostic value of (18)F-FDG PET/CT with texture analysis in patients with rectal cancer treated by surgery. Ann Nucl Med 2021;35:843-52.

https://dx.doi.org/10.21037/qims-23-692