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The role of baseline mesorectal fascia status and its change after neoadjuvant therapy in predicting prognosis in locally advanced rectal cancer

Short title: The mesorectal fascia status can predict prognosis in locally advanced rectal cancer

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ABSTRACT

Objective: To analyze the role of baseline mesorectal fascia (MRF) status and the correlation between MRF changes and prognosis after neoadjuvant therapy in patients with locally advanced rectal cancer.

Methods: Totally 321 patients with locally advanced rectal cancer were retrospectively analyzed from January 2014 to December 2016 in Peking University Cancer Hospital. All Patients underwent surgery after neoadjuvant radiotherapy and chemotherapy, and were followed up regularly after surgery. The MRF status, extramural vascular invasion (EMVI) status, tumor location, tumor stage and lymph node status were evaluated on baseline MRI. For patients with positive baseline MRF, preoperative MRF status was also evaluated. Chi-square test or independent t test were used to compare the characteristics between MRF positive and negative patients. Kaplan-Meier curve, log-rank test and multivariate Cox regression were used to analyze the correlation between imaging features and prognosis.

Results: In all of the 321 subjects, 193 (60.1%) had positive baseline MRF, 54 (28.0%) of the 193 patients had negative MRF after neoadjuvant therapy, and 139 (72.0%) of them still had positive MRF preoperatively. The postoperative pathological T and N stages were significantly higher in patients with positive baseline MRF than those with negative MRF, and the proportion of patients achieving complete pathological response was significantly lower than those with negative MRF (All $P < 0.05$). The postoperative pathological T and N stages of patients with MRF negative conversion were significantly lower than those without MRF negative conversion. In patients with negative baseline MRF and patients with negative MRF conversion after neoadjuvant therapy, the proportion of positive MRI EMVI was significantly lower (All $P < 0.05$). Univariate survival analysis showed that overall survival and metastasis free survival were poorer in patients with positive MRF at baseline, with a hazard ratio of 3.33 and 1.69, respectively. There was no significant correlation between negative MRF conversion after neoadjuvant therapy and overall survival, metastasis free survival and recurrence free survival. Multivariate Cox analysis showed that baseline MRF and EMVI status were independent factors for overall survival and metastasis free survival,

with a risk ratio of 2.15 and 3.35 for overall survival, 1.13 and 2.74 for metastasis free survival, respectively.

Conclusions: Baseline MRF status is one of the independent prognostic predictors in locally advanced rectal cancer patients with neoadjuvant therapy. However, the role of the change in MRF status after neoadjuvant therapy is uncertain for predicting prognosis.

Key words: Rectal neoplasms; Mesorectal fascia; Magnetic resonance imaging; Prognosis

INTRODUCTION

In the treatment of rectal cancer, postoperative pathological circumferential margin invasion is an important factor for poor prognosis of patients.[1, 2] Pelvic MRI is the preferred imaging method for rectal cancer which recommended by the European Society of Radiology.[3–5] High resolution MRI can be exploited to measure the distance between the deepest tumor invasion or perirectal lymph nodes within mesorectal fascia (MRF) to MRF for MRF status evaluation, which is corresponding to the ideal circumferential margin in pathological concept. It is defined as MRF negative, if the distance >1 mm; otherwise, defined as MRF positive, if the distance ≤ 1 mm.[6, 7] Studies have shown a higher risk of postoperative local recurrence and distant metastasis in rectal cancer patients with positive preoperative MRF.[2, 8, 9] However, for patients with locally advanced rectal cancer, there are few studies on the correlation between baseline MRF status with the efficacy and prognosis of neoadjuvant therapy. Also, it is still unclear about the impact of MRF status changes brought by neoadjuvant therapy on prognosis. In this study, the authors aimed to analyze the correlation between the baseline MRF status with MRF changes after neoadjuvant therapy and prognosis in locally advanced rectal cancer patients with neoadjuvant therapy, for providing further information for the development of clinical treatment procedures.

MATERIALS AND METHODS

Patients

This retrospective study was approved by the ethics committee of Beijing Cancer Hospital(2020KT53). The informed consent requirement was waived. Patients with locally advanced rectal cancer surgical treatment were retrospectively included from January 2014 to December 2016 in Peking University Cancer Hospital. The inclusion criteria were: (i) biopsy-tested primary rectal adenocarcinoma; (ii) received pelvic MRI before and after neoadjuvant chemoradiotherapy; (iii) locally advanced rectal cancer determined as ≥ T3 or positive nodal status by pretreatment MRI; (iv) completed neoadjuvant chemoradiotherapy before surgery; (v) Total mesorectal excision (TME) surgery was performed after completion of neoadjuvant chemoradiotherapy; (vi)

postoperative follow-up. The exclusion criteria were: (i) previous history of malignant tumors or other malignant tumors; (ii) insufficient MRI quality to obtain measurements; (iii) lack of pathologic materials after TME or pathologically tested mucinous adenocarcinoma; (iv) loss of follow-up within 3 months after the TME (i.e. without any follow-up information after TME).

A total of 376 patients were collected in this study. 55 patients were excluded, including 9 patients without completed neoadjuvant therapy, 11 patients who did not receive TME, 4 patients with tumor history or other tumors, 5 patients with pathologically tested mucinous adenocarcinoma, 18 patients without baseline or preoperative MRI, and 8 patients without postoperative follow-up. 321 patients were finally included, with 218 males and 103 females, aged 21–80 (54 ± 12) years.

MRI protocol and parameter

All Patients underwent MRI at 2-time points: within 1 week before the initiation of neoadjuvant chemoradiotherapy and after neoadjuvant chemoradiotherapy within 1 week before surgery, respectively. All MRI were performed with a 3.0-T MR scanner (GE Healthcare) applying an 8-channel phased array body coil. For reducing colonic motility, 20 mg of scopolamine butylbromide was intramuscularly injected 30 minutes prior to MRI scanning. Protocol and parameter: T2WI images were obtained using fat recovery fast spin echo with TR = 5,694 ms, TE = 110 ms, FOV = 180 × 180 mm, matrix = 288 × 256, echo train length = 24, thickness = 3.0 mm, and gap = 0.3 mm. DWI images were obtained using single-shot echo-planar imaging with 2 b-factors (0 and 1,000 s/mm^2), and repetition time (TR) = 2,800 ms, echo time (TE) = 70 ms, field of view (FOV) = 34 × 34 cm, matrix = 256 × 256, thickness = 4mm, and gap = 1mm.

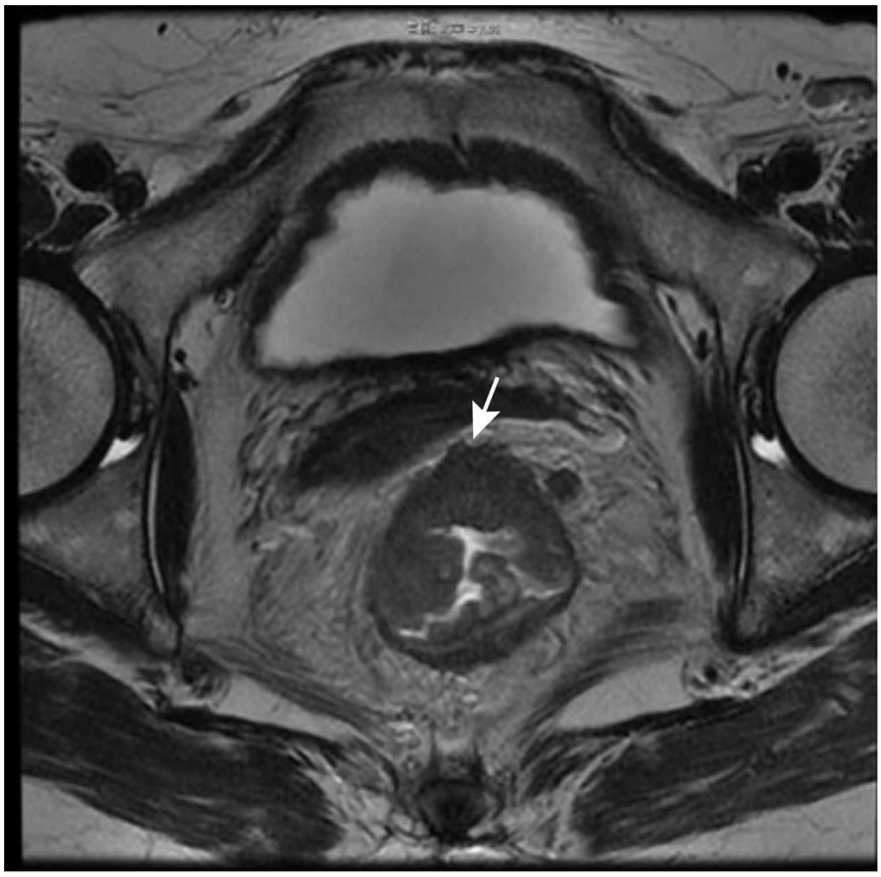
Neoadjuvant chemoradiotherapy regimens

Intensity-modulated radiation therapy (IMRT) was administered. The IMRT regimen comprised 22 fractions with a total dose of 50.0–55.0 Gy,1.8–2.0 Gy/per time.[10] Capecitabine treatment was administered concurrently with IMRT at a dose of 825 mg/m^2 (oral, twice per day). TME-based surgery was recommended 8–11 weeks after

completing chemoradiotherapy.

Image Analysis

All Patients' baseline and preoperative MRI image characteristics were assessed by two radiologists independently as following. (1) Assessment of the MRF status was based on the measured distance between the most outer margin of tumor and MRF on axial T2WI (showing as clear low signal-lineal structure on T2WI), the distance ≤ 1 mm as MRF positive, and > 1 mm as MRF negative (Figure 1, 2).[6, 7] (2) Assessment of tumor stage (MRI T stage). (3) Assessment of lymph node stage (MRI N stage). (4) Assessment of extramural vascular invasion (EMVI) status was based on the MRI-EMVI score (score of 0–2 as negative, score of 3–4 as positive). The score of 0 is that the pattern of tumor extension through the muscle is not nodular, and there is no vascular structure adjacent to areas of tumor penetration. The score of 1 is the beaded/nodular extension or the persistence of minimal extramural vessels, but not adjacent to areas of tumor. The score of 2 is that the beaded tumor is in the vicinity of extramural vessels, but these vessels are of normal caliber, and there is no definite tumor signal within the vessel. The score of 3 is that the intermediate signal intensity is apparent within vessels, although the contour and caliber of these vessels are only slightly expanded. The score of 4 is that the definite tumor signal is apparent within vessels adjacent to tumor with obvious irregular vessel contour or nodular expansion of vessel.[11, 12] (5) Assessment of tumor location was according to the measured distance of inferior border of the tumor to the anal verge, which was categorized 0–5 cm as low, 5–10 cm as middle, and 10–12 cm as high. Patients with positive baseline MRF and negative preoperative MRF is determined as MRF negative conversion, while with positive preoperative MRF is determined as without MRF negative conversion. When the assessment of the two radiologists are inconsistent, a third senior radiologist (with more than 15 years of experience in rectal MRI) arbitrates to the final diagnosis and brings it into the survival analysis.



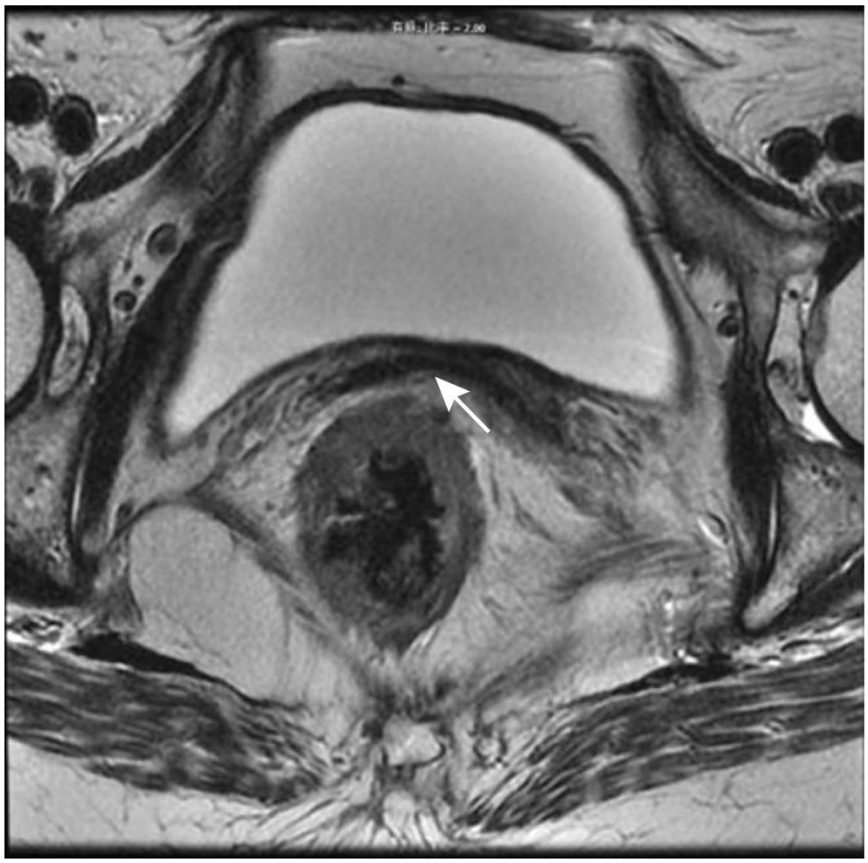


Figure 1, 2. High resolution T2WI images show mesorectal fascia (MRF) status in patients with locally advanced rectal cancer. Figure 1 shows a 52-year-old patient with

rectal cancer. The deepest tumor invasion in the anterior wall of the rectum (twelve-o'clock position↑) was closely associated with the MRF (distance <1 mm), suggesting positive baseline MRF. Figure 2 shows a 55-year-old patient with rectal cancer who still had visible mesorectal fat between the deepest tumor invasion in the left anterior wall of the rectum (one-o'clock position↑) and the adjacent MRF (distance >1 mm), indicating negative baseline MRF.

Pathology Analysis

The surgically resected specimens were prepared for pathologic analysis according to the 7th edition of TNM staging system published by the American Joint Committee on Cancer.[13] It was analyzing the EMVI, tumor stage (pT: T0–4), lymph node status (pN: N0–2), MRF status and pathological complete response(pCR). pCR was defined as the absence of living tumor cells in both the primary tumor and lymph nodes.

Follow-up

All Patients underwent standard out-patient follow-up after surgery, including examination of blood routine, blood biochemistry, tumor markers and CT (the contrast-enhanced CT of abdomen and pelvis and chest CT scans). After TME surgery, participants were followed up until death, usually every 3 months for first 2 years, then every 6 months for next 3 years, and once per year thereafter. The period from the date of surgery to the occurrence of distant metastasis was recorded as metastasis free survival. The period from the date of surgery to the occurrence of local recurrence was recorded as recurrence free survival. And the time from the date of surgery to the tumor-related death was recorded as overall survival. The last follow-up date was December 31, 2019.

Statistical analysis

All statistical analyses were carried out with SPSS version 22.0 (IBM Corp., Chicago, IL, USA). The quantitative data were described as Mean ± SD. Kappa consistency

coefficient was used to determine the consistency of the two radiologists' evaluation of image feature, and a Kappa > 0.80 indicating excellent correlation,0.61–0.80 as good correlation, 0.41–0.60 as moderate correlation, 0.21–0.40 as fair correlation, < 0.20 as poor correlation. Chi-square test and independent t-test were used to compare the characteristics between MRF positive and negative patients and between patients with and without negative MRF conversion after neoadjuvant therapy. Kaplan-Meier method was used to draw the survival curve. The survival curve was compared with the log rank test. And multivariate Cox regression was used to obtain imaging features that affected prognosis. $P < 0.05$ was defined as statistical significance.

RESULTS

Patient characteristics

In all of the 321 patients with locally advanced rectal cancer, 56 (17.4%) were pathological T0 stage, 7 (2.2%) were T1 stage, 94 (29.3%) were T2 stage,164 (51.1%) were T3 stage; and 223 (69.5%) were pathological N0 stage, 70 (21.8%) were N1 stage, 28 (8.7%) were N2 stage. And 50 (15.6%) achieved pCR. According to the baseline MRI, 193 (60.1%) were positive MRF, 128 (39.9%) were negative MRF;154 (48%) were positive EMVI, 167 (52%) were negative EMVI; 22 (6.9%) were MRI T2 stage, 220 (68.5%) were MRI T3 stage, 79 (24.6%) were MRI T4 stage; 48 (15.0%) were positive MRI N, 273 (85.0%) were negative MRI N;150 (46.7%) were low tumor, 150 (46.7%) were middle tumor, 21 (6.6%) were high tumor.

193 patients were positive baseline MRF, of which 54 (28.0%) were negative MRF conversion, and the rest 139 (72.0%) patients were still positive MRF, while after neoadjuvant therapy at preoperative MRI.

Median follow-up duration was 37 months (range, 4–77 months). 61 (19.0%) patients died, 82 (25.5%) had distant metastasis, and 16 (5.0%) had local recurrence.

Associations between baseline MRF status and the imaging, clinical, and pathological features

The postoperative pathological T and N stages were significantly higher in patients with

positive baseline MRF than those with negative MRF, of which 63.7% and 32.0% were pathological T3 stage, 36.8% and 21.1% were positive pathological N, respectively. The difference was statistically significant ($P < 0.05$, Table 1). And the proportion of patients achieving pCR after neoadjuvant therapy was significantly lower than those with negative baseline MRF, which were 8.3% and 26.6%, respectively. The difference was statistically significant ($P < 0.001$, Table 1). The proportion of patients who had baseline MRI T3–4 stage with positive baseline MRF was higher than those with negative MRF, which were 99.5% and 83.6%, respectively. The difference was statistically significant ($P < 0.001$, Table 1). In patients with positive baseline MRF, the proportion of positive baseline MRI EMVI was significantly higher than those with negative MRF, which were 61.1% and 28.1% respectively. The difference was statistically significant ($P < 0.001$, Table 1).

The age of positive baseline MRF and negative patients was (56 ± 11) years and (53 ± 13) years, respectively, which was no significant difference ($t = 1.849$, $P = 0.065$). Also, there were no statistically significant differences between positive baseline MRF and negative patients in gender, baseline CEA level, tumor location, or baseline MRI N stage (All $P > 0.05$, Table 1).

For the two radiologists, the assessment of all baseline MRI indicators was performed with excellent or good consistency, with a Kappa coefficient 0.737–0.924, and a Kappa coefficient of 0.883 for the consistency of baseline MRF.

Table 1. Comparison of imaging, clinical and pathological features between positive and negative baseline MRF patients with locally advanced rectal cancer [*n* (%)]

		Negative baseline MRF	Positive baseline MRF	χ^2 Value	*P*
Sex	Male	92(71.9)	126(65.3)	1.534	0.216
	Female	36(28.1)	67(34.7)		
Baseline CEA (ug/ml)	<5	88(68.8)	120(62.2)	1.458	0.227

	≥5	40(31.2)	73(37.8)		
pT	T0-2	87(68.0)	70(36.3)	30.948	<0.001
	T3	41(32.0)	123(63.7)		
pN	N0	101(78.9)	122(63.2)	8.937	0.003
	N1-2	27(21.1)	71(36.8)		
pCR	Yes	34(26.6)	16(8.3)	28.407	<0.001
	No	94(73.4)	177(91.7)		
Tumor Location	Low	67(52.3)	83(43.0)	2.696	0.101
	High-Middle	61(47.7)	110(57.0)		
MRI-EMVI	Negative	92(71.9)	75(38.9)	33.609	<0.001
	Positive	36(28.1)	118(61.1)		
MRI-T	T0-2	21(16.4)	1(0.5)	30.431	<0.001
	T3-4	107(83.6)	192(99.5)		
MRI-N	N0	17(13.3)	31(16.1)	0.468	0.494
	N1/2	111(86.7)	162(83.9)		

MRF, mesorectal fascia; CEA, carcino-embryonic-antigen; pCR, pathological complete response; and EMVI, extramural vascular invasion.

Associations between MRF changes after neoadjuvant therapy and the imaging, clinical, and pathological features

The postoperative pathological T and N stages of patients with MRF negative conversion were significantly lower than those without MRF negative conversion, with the pathological T3 stage of 50.0% and 69.1% and positive pathological N of 18.5% and 43.9%, respectively. And it was statistically significant difference (All $P < 0.05$, Table 2). In patients with negative MRF conversion, the proportion of positive baseline MRI EMVI was significantly lower than those without negative MRF conversion, which was 48.1% and 66.2%, respectively ($P = 0.021$, Table 2). There were no statistically significant differences between patients with and without negative MRF conversion in gender, baseline CEA level, tumor location, the proportion of pCR, or baseline MRI T and N stages (All $P > 0.05$, Table 2). The age of patients with and

without negative MRF conversion was (56 ± 12) years and (52 ± 13) years, respectively, which was no significant difference (t = 1.464, P = 0.145).

The kappa coefficient of the consistency of two radiologists on MRF status assessment after neoadjuvant therapy was 0.803.

Table 2. Comparison of imaging, clinical and pathological features between patients with and without negative MRF conversion after neoadjuvant therapy [n (%)].

		With negative MRF conversion	Without negative MRF conversion	χ^2 Value	P
Sex	Male	34(63.0)	92(66.2)	0.178	0.673
	Female	20(27.0)	47(33.8)		
Baseline CEA (ug/ml)	<5	38(70.4)	82(59.0)	2.141	0.143
	≥5	16(29.6)	57(41.0)		
pT	T0–2	27(50.0)	43(30.9)	6.115	0.013
	T3	27(50.0)	96(69.1)		
pN	N0	44(81.5)	78(56.1)	10.761	0.001
	N1–2	10(18.5)	61(43.9)		
pCR	Yes	6(11.1)	10(7.2)	0.785	0.391
	No	48(88.9)	129(92.8)		
Tumor Location	Low	22(40.7)	61(43.9)	0.157	0.692
	High-Middle	32(59.3)	78(56.1)		
MRI-EMVI	Negative	28(51.9)	47(33.8)	5.327	0.021
	Positive	26(48.1)	92(66.2)		
MRI-T	T0–2	1(1.9)	0(0)	2.587	0.108
	T3–4	53(98.1)	139(100)		
MRI-N	N0	12(22.2)	19(13.7)	2.110	0.146
	N1/2	42(67.8)	120(86.3)		

MRF, mesorectal fascia; CEA, carcino-embryonic-antigen; pCR, pathological complete

response; and EMVI, extramural vascular invasion.

Associations between baseline MRF status and MRF changes after neoadjuvant therapy and prognosis

Kaplan-Meier method was applied to draw the survival curve, the comparison of the survival curve showed that patients with positive baseline MRF and positive EMVI had poorer overall survival and metastasis free survival (All $P < 0.05$, Table 1). The hazard ratio for overall survival were 3.33 and 4.28, and for metastasis free survival were 1.69 and 3.25, respectively. Patients with higher preoperative CEA levels had lower metastasis free survival ($P = 0.015$). There was no significant correlation between negative MRF conversion after neoadjuvant therapy with overall survival, metastasis free survival and recurrence free survival. (All $P > 0.05$) (Table 3, Figure 3–8).

Multivariate Cox analysis showed that baseline MRF and EMVI status were independent factors for overall survival and metastasis free survival ($P = 0.028$, < 0.001), with a hazard ratio of 2.15 (95% CI 1.09–4.27) and 3.35 (95% CI 1.79–6.26) for overall survival, 1.13 (95% CI 1.02 to 1.25) and 2.74 (95% CI 1.68 to 4.47) for metastasis free survival, respectively.

Table 3. Survival curve comparison of prognostic factors in patients with locally advanced rectal cancer.

	Overall Survival		Metastasis free survival		Relapse-free survival	
	HR (95%CI)	*P*	HR (95%CI)	*P*	HR (95% CI)	*P*
Age	0.99 (0.97–1.01)	0.450	0.99 (0.98–1.02)	0.905	0.97 (0.93–1.00)	0.058
Sex	1.17 (0.70–1.98)	0.550	1.02 (0.64–1.61)	0.934	1.22 (0.44–3.36)	0.707
Baseline CEA (ug/ml)	1.46 (0.88–2.42)	0.147	1.72 (1.11–2.65)	0.015	0.86 (0.30–2.48)	0.783
Tumor Location	0.88 (0.60–1.28)	0.492	1.03 (0.75–1.43)	0.850	1.05 (0.50–2.18)	0.902
MRI-EMVI	4.28 (2.35–7.78)	<0.001	3.25 (2.02–5.21)	<0.001	2.86 (0.99–8.26)	0.053

Baseline MRF	3.33 (1.73–6.40)	<0.001	1.69 (1.06–2.71)	0.029	3.04 (0.86–10.67)	0.083
MRI-T	4.51 (0.62–32.55)	0.136	2.09 (0.66–6.64)	0.211	22.53 (0.01–110 696.02)	0.473
MRI-N	2.58 (0.93–7.10)	0.068	0.87 (0.48–1.53)	0.604	2.63 (0.35–19.55)	0.350
With negative MRF conversion	1.22 (0.64–2.34)	0.546	1.35 (0.73–2.51)	0.342	2.05 (0.45–9.27)	0.350

281 CEA, indicates carcino-embryonic-antigen; EMVI, extramural vascular invasion; MRF,

282 mesorectal fascia; and HR, hazard ratio.

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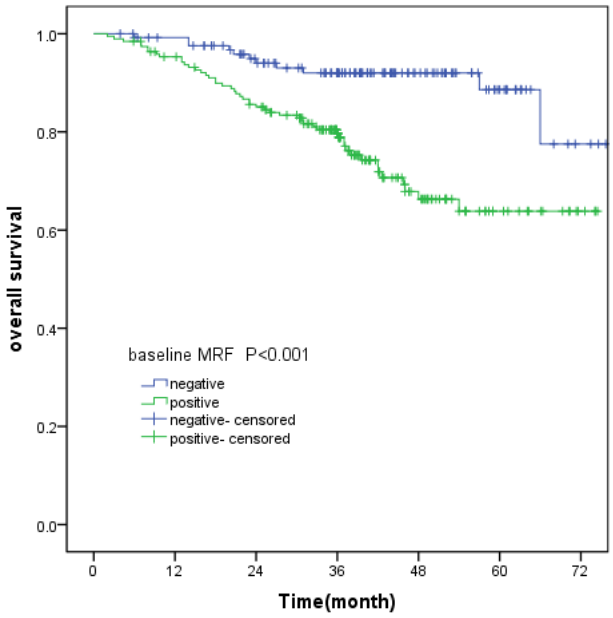

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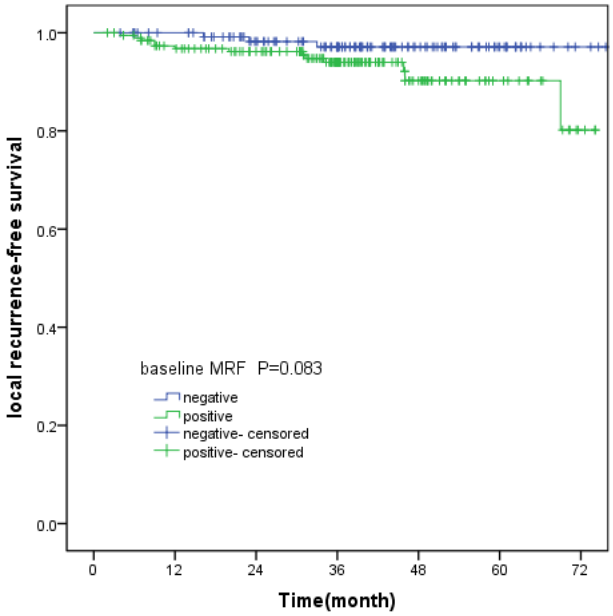
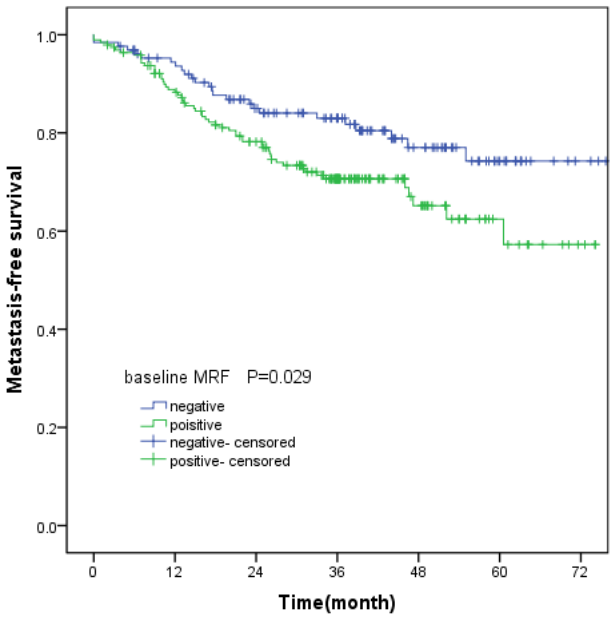
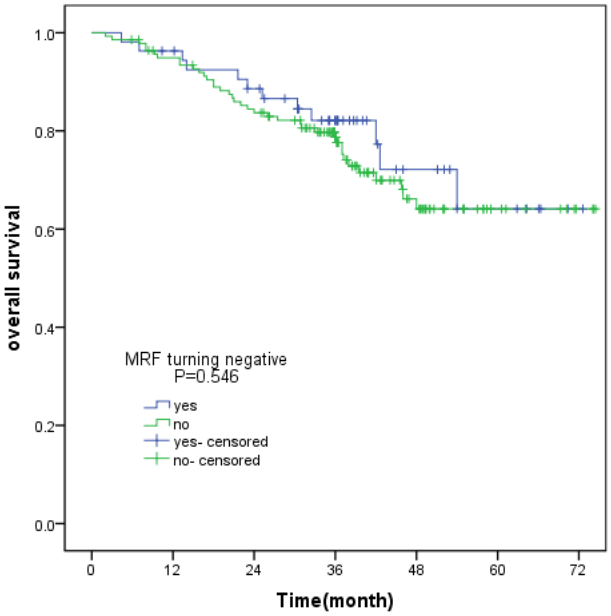

local recurrence-free survival
1.0
0.8
0.6
0.4
0.2
0.0
baseline MRF P=0.083
negative
positive
negative- censored
positive- censored
0
12
24
36
48
60
72
Time(month)

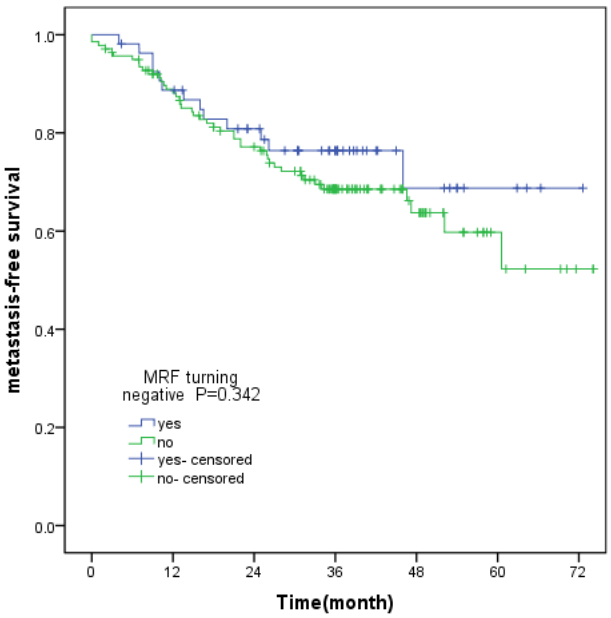
285


Metastasis-free survival
1.0
0.8
0.6
0.4
0.2
0.0
baseline MRF P=0.029
negative
poisitive
negative- censored
positive- censored
0
12
24
36
48
60
72
Time(month)

286


overall survival
1.0
0.8
0.6
0.4
0.2
0.0
MRF turning negative
P=0.546
yes
no
yes- censored
no- censored
0
12
24
36
48
60
72
Time(month)

287


metastasis-free survival
1.0
0.8
0.6
0.4
0.2
0.0
MRF turning
negative P=0.342
yes
no
yes- censored
no- censored
0
12
24
36
48
60
72
Time(month)

288

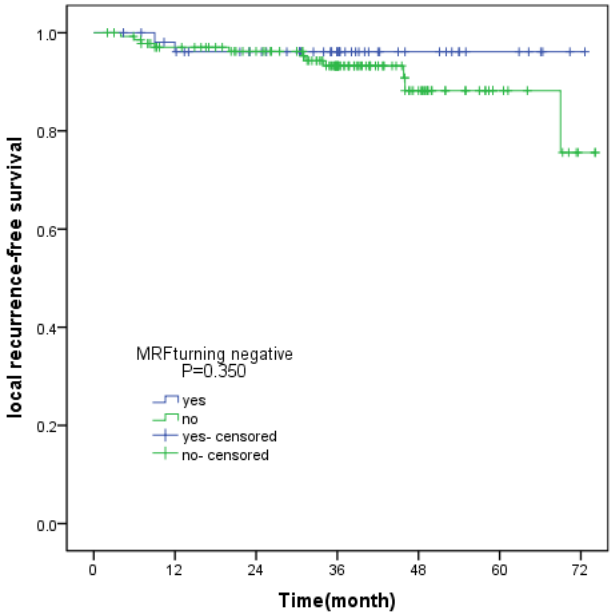


Figure 3–8. The survival curves of patients with locally advanced rectal cancer.

Figure 3–5. Show the overall survival, metastasis free survival and recurrence free survival curves in positive and negative baseline mesenteric fascia (MRF) patients, respectively.

Figure 6–8. Show the overall survival, metastasis free survival and recurrence free survival curves in patients with and without negative MRF conversion after neoadjuvant therapy, respectively.

DISCUSSION

The results of this study showed that baseline MRF status was an independent prognostic predictor in rectal cancer patients with neoadjuvant therapy; and the overall survival and metastasis free survival of positive MRF patients were poor, which was consistent with previous studies.[5, 12] The study found that patients with higher pathological T and N stages were more likely positive MRF, which is because the higher tumor stage refers to the deeper invasion and account for the higher possibility of positive MRF; and metastatic lymph nodes in the mesentery affect the assessment of MRF directly. The results of this study showed that 99.5% positive baseline MRF patients with MRI stage T3–4, which was significant difference from negative MRF

patients (83.6%), however, there was no significant difference in the baseline MRI N stage, which may be due to the low diagnostic accuracy of MRI N stage.

The assessment of MRF requires accurate measurement, affecting many factors, including MRI scan direction, tumor, neoadjuvant chemoradiotherapy and mesorectal lymph nodes, etc. In the study of Granero-Castro *et al*.,[14] comparing with ultrasound endoscopy and CT, MRI was higher accuracy in the assessment of MRF; however, while applying MRI for assessment, the measured value is usually higher than the real value, because as a two-dimensional image, the scan direction is generally at a certain angle with rectal. The accuracy of MRF assessment was related to the lymph node involvement, tumor location and perirectal fat thickness in the anterior wall.[15] Some studies showed that the false positive rate of MRF in the anterior wall rectal cancer was significantly higher than those in the posterior or lateral wall.[16] Tumor fibrosis and tissue edema caused by neoadjuvant radiotherapy can also affect MRF assessment.[17] In addition, when there are metastatic lymph nodes in the mesentery, the distance between the metastatic lymph nodes and the circumferential resection margin should be measured to judge the MRF status. However, the specificity of evaluation of lymph nodes in the mesentery is low, especially after neoadjuvant therapy.[18]

Previous studies have shown that negative MRF conversion after neoadjuvant therapy is a factor indicating a good prognosis of rectal cancer. Patients with negative MRF conversion have a higher rate of 3 years recurrence, disease free survival and overall survival than patients with persistent positive MRF.[19] Our study had not found negative MRF conversion was a good prognosis indication factor, which may be related to the differences in positive baseline MRF rate and negative MRF conversion rate among different subjects. In this study, although there was no correlation between negative MRF conversion after neoadjuvant therapy with pCR and prognosis, preoperative MRF status theoretically reflects pathological circumferential margin status, which will directly affect the selection of surgical method and postoperative treatment plan. And it is still an important indicator for preoperative MRI evaluation.

There are some limitations to this study. Firstly, our study is a retrospective, single-center study. Although we found that among baseline MRI indicators, MRF and EMVI

were superior predictors of prognosis than traditional T and N tumor stages, the results need to be validated in a wider population. Secondly, MRF invasion includes direct tumor invasion, tumor nodule invasion, metastatic lymph node invasion, EVMI invasion and others. In the data of our center, direct tumor invasion accounts for more than 80%, and the remaining 20% mainly includes lymph node invasion and EMVI invasion. However, the various conditions were not correspondingly classified and analyzed considering that the low diagnostic overall accuracy of lymph node metastasis and EMVI and highly subjectivity. Thirdly, due to the low proportion of patients with local recurrence among the study population, a significant association between MRF and recurrence was not found, which may be related to the insufficient sample size. In addition, the assessment of baseline and preoperative MRF status were affected by radiologists' experience and diagnostic level. Although the consistency analysis showed a good consistency among researchers, the correlation between diagnostic accuracy of MRF and radiologists' experience should be investigated in future studies to further evaluate the reliability of this indicator.

In conclusion, baseline MRF status of rectal cancer patients are significantly correlated with the efficacy of neoadjuvant therapy and is one of the important predictors of prognosis. The results of this study support to use baseline MRF status assessment as a routine assessment for rectal cancer patients, and suggest adding this indicator to relevant imaging and clinical guidelines for guiding clinical procedures. However, the role of the negative MRF conversion after neoadjuvant therapy is uncertain for predicting prognosis, and further large-sample, multi-center studies are needed.

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Ethics Approval and Consent to Participate

This retrospective study was approved by the ethics committee of Beijing Cancer Hospital(2020KT53).

Conflict of Interests

None declared.

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