www.nclinmed.com
Novelty in Clinical Medicine. 2022; 1(3): 127-134
https://doi.org/10.22034/NCM.2022.337938.1041

Research Article Open Access

Preoperative evaluation of pelvic MRI findings in patients with rectosigmoid cancer in Golestan province (north of Iran)

Navid Najafi [1], **Mohammad Hadi Gharib** [2], **Nematollah Nematollahi** [2*], **Fatemeh Mehravar** [3]

[1] Specialist Radiology, Golestan University of Medical Sciences, Gorgan, Iran
[2] Assistant Professor of Radiology, Department of Radiology, School of Medicine, 5th Azar Hospital, Golestan University of Medical Sciences, Gorgan, Iran
[3] PhD in Epidemiology, Department of Epidemiology and Biostatistics, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran

* **Corresponding author:** Nematollah Nematollahi. Department of Radiology, School of Medicine, 5th Azar Hospital, Golestan University of Medical Sciences, Gorgan, Iran **Email:** nematollah@yahoo.com

Received: 16 April 2022 **Revised:** 23 April 2022 **Accepted:** 30 April 2022 **e-Published:** 1 May 2022

Abstract

Background: Colorectal cancer (CRC) is the third leading cause of death globally, representing 16% of all new cancer cases. Early detection of metastatic disease is crucial as it significantly influences treatment options. Magnetic resonance imaging (MRI) is widely regarded as the gold standard for preoperative assessment in CRC.

Objectives: The aim of this study was to investigate MRI findings in patients with rectosigmoid cancer in Gholestan Province, northern Iran, from 2019 to 2020.

Methods: This is a retrospective cross-sectional study that was performed on 43 patients with rectal cancer in Gorgan. Patients with other cancers, metastatic cancer, and a history of surgery were excluded. Demographic data (age, gender, and ethnicity) was obtained from patients' electronic records, and patients' MRI information was obtained through the Picture Archival and Communication System (PACS) of Gorgan MRI centers.

Results: Among 43 patients with rectosigmoid cancer, 65.1% of them were male, and the mean age was 58.58±14.73 years. The average mass length was 48.44 mm, and the distance from the anal verge was 69.81 mm. The most common morphology of patients' rectosigmoid masses in imaging was related to semicircular (51.2%) and circumscription (32.6%). T1/T2, N2a, and M0, with the percentages of 41.9%, 39.5%, and 90.7%, respectively, had the highest frequency in patients. TNM staging was not significantly related to gender or ethnicity. Peritoneal reflection was also more common in Sistan and Turkmen ethnic groups.

Conclusion: The findings of this study indicate that high-resolution MRI using an appropriate imaging protocol can provide accurate regional staging essential for optimal treatment.

Keywords: Rectosigmoid cancer, Rectum cancer, Colorectal cancer, Magnetic Resonance Imaging.

Introduction

Colorectal cancer (CRC) is the third-leading cause of death globally and accounts for 16% of all new cancer diagnoses.[1] Approximately 14.4% of newly diagnosed cases of CRC present with distant metastases at the time of diagnosis, while 50% of patients will eventually develop metastatic disease.[2] In Iran, CRC ranks as the fifth most common cancer among men and third among women.[3]

Although the advent of targeted therapeutic agents has improved the survival rate of metastatic disease, the overall therapeutic goal for metastatic CRC remains palliative care.[4] Recent advances in endoscopic tools and techniques have increased the detection of colon lesions, colon cancers, and adenomas. Accurate lymph node (LN) metastasis evaluation in CRC is critical for selecting suitable treatment options, such as endoscopic resection or surgery, as well as a prognostic factor.[5,6]

Because of its ability to provide anatomical details with high soft tissue contrast while also providing insights into tissue composition via diffusion-weighted imaging (DWI), perfusion imaging, and liver-specific T1 contrast imaging, magnetic resonance imaging (MRI) has emerged as a valuable tool for cancer staging.[7] MRI is highly accurate for metastatic disease without scattering ionizing radiation. MRI is a safer, more efficient, and more accurate alternative to the standard approach, eliminating unnecessary interventions and increasing both diagnostic accuracy and patient survival rates.[8] One benefit of MRI over endoscopic ultrasound (EUS) is that it is not affected by tumor stenosis and does not allow distant metastases to go unnoticed. Therefore, MRI is deemed a more superior method for preoperative evaluation.[9]

Objectives

Preoperative evaluations are of utmost importance in rectal cancer as the treatment decision heavily relies on radiological findings.[10] Given the high prevalence of CRC in Gholestan province, northern Iran,[11] and the scarcity of relevant research in this area, we performed this study to evaluate radiological findings in pelvic magnetic resonance imaging (MRI) of CRC patients in Gholestan province.

Methods

This study is a retrospective cross-sectional analysis. The study population consists of all patients with a final diagnosis of rectal cancer who were referred to Gorgan Teaching and Medical Hospitals during 2019–2020. The sampling method used was a census. Patients with other types of cancer, metastatic cancer, previous surgery, or incomplete records were excluded. Data was collected from patients' clinical records. A researcher-designed questionnaire consists of two parts: demographic and clinical data. Demographic data included age, gender, ethnicity, and family history of cancer. MRI findings such as tumor location and form, T and N categories, extramural vascular invasion, and connections with surrounding structures were obtained from the picture archiving and communication systems (PACS) of Gorgan's MRI facilities (Eizadi and Gholestan Medical Imaging).

Statistical Analysis

The collected data were analyzed by using STATA software version 14. The continuous variables were expressed as the mean±SD, and the categorical variables were presented as a percentage. Chi-square, independent t-test, and analysis of variance were used for data analysis. P-value less than 0.05 was considered statistically significant.

Ethical consideration

Ethical approval for this study was obtained from the Ethics and Research Committee of Gholestan University of Medical Sciences (IR.GOUMS.REC.1400.202). Additionally, due to the retrospective nature of the study and the use of medical records, informed consent was not required. We adhered to the guidelines on research involving human subjects (beneficence, non-maleficence, veracity, confidentiality, and voluntarism) as outlined in the Helsinki Declaration. Furthermore, participants did not incur any costs or receive any financial inducements for their participation in the study.

Results

Preoperative MRI of the pelvis was performed in 43 rectosigmoid cancer patients with a mean age of 58.58 ± 14.73 years (range: 21 to 86 years). Of these patients, 28 (65.1%) were male, while the remaining 15 (34.9%) were female. Additionally, 30 (69.8%) were of Persian ethnicity, 9 (20.9%) were Turkmen, and 4 (9.3%) were Sistani.

As shown in Table 1, the most common morphology of patients' rectosigmoid masses in imaging was related to semicircular (51.2%) and circumferential (32.6%). Additionally, all polyp-like infiltrative masses were associated with female sex and Turkmen ethnicity, and all polyp-like masses were found in males and Persian ethnicity. The length of rectal mass in men and women was 49.61 ± 19.82 and 46.27 ± 15.76 mm, respectively, but the difference was not statistically significant.

For patients with polypoid and semicircular masses, the locations of the beginnings and ends of the rectosigmoid masses were recorded, with frequencies of 22.2% and

14.8% for the beginnings of the 9 and 8 o'clock masses, respectively, and for the ends of the 2 o'clock mass. Additionally, 18.5% was the most common situation.

Rectosigmoid masses were metastatic in 5 patients (11.6%), of whom 3 (10.7%) were male and 2 (13.3%) were female. This difference was not statistically significant. Among the TNM stages analyzed, T1/T2, N2a, and M0 had the highest frequencies among patients whose TNM staging was not related to gender or ethnicity. Table 2 displays the TNM staging of rectal cancer, where T represents the tumor, N indicates the lymph nodes near the tumor, and M indicates whether the tumor has metastasized.

When compared to other morphologies, masses with infiltrative polypoid and circumferential morphologies were more likely to penetrate peripheral fat (66.7% and 78.6%, respectively). However, this difference was not statistically significant. Conversely, half of the polypoid masses invaded the mesorectal fascia, whereas the majority of other morphologies failed to do so, and this difference was statistically significant (P=0.028). Additionally, there was no significant difference in terms of extra-mural vessel invasion (EMVI), organ invasion, metastasis, or staging among different morphological types. Significantly, masses with infiltrative polypoid and circumferential morphologies had a greater incidence of peritoneal reflection involvement, with 100% and 40%, respectively, which was statistically significant (P=0.006).

Table-1. Clinical characteristics of patients with colorectal cancer examined with preoperative MRI in Golestan province, Iran

Morphology	Polypoid	4 (9.3%)
	Semi Circumferncial	22 (51.2%)
	Circumferncial	14 (32.5%)
	Infiltrative Polypoid	3 (7%)
Mucinous	Yes	4 (9.3%)
	No	39 (90.7%)
Craniocaudal Length (mm) Mean±SD	48.44±18.38	
Male	49.61±19.82	
Female	46.27±15.76	
Distance of Rectal Cancer from the Anal Verge (mm) Mean±SD	69.81±29.05	
	67.75±29.23	
	73.67±29.33	
Elementary Circumferential Location (o'clock position)	11 and 3 o'clock	9 (28.12%)
	3 and 7 o'clock	5 (15.63%)
	7 and 11 o'clock	18 (56.25%)
Terminal Circumferential Location (o'clock position)	11 and 3 o'clock	13 (40.63%)
	3 and 7 o'clock	8 (25%)
	7 and 11 o'clock	11 (34.37%)
Fat Surrounding Rectum Invasion	Yes	24 (55.8%)
	No	19 (44.2%)
Invasion size (mm) Mean±SD	7.71±8.96	
Mesorectal Fascia Invasion (MRF)	Yes	3 (6.98%)
	No	40 (93.02%)
Extramural Vascular Invasion (EMVI)	Yes	2 (4.7%)
	No	41 (95.3%)
Adjacent Organ Invasion	Yes	5 (11.6%)
	No	38 (88.4%)
Metastasis	Yes	5 (11.6%)
	No	38 (88.4%)
T Staging	T1or T2	18 (41.8%)
	T3a	1 (2.3%)
	T3c	10 (23.3%)
	T3d	6 (14.0%)
	T4a	4 (9.3%)
	T4b	4 (9.3%)

N Staging	N0	10 (23.3%)
	N1a	4 (9.3%)
	N1b	5 (11.6%)
	N2a	17 (39.5%)
	N2b	7 (16.3%)
M Staging	M0	39 (90.7%)
	One organ	2 (4.7%)
	Two organs and more	1 (2.3%)
	Seeding (M1c)	1 (2.3%)
Staging	Stage 1	6 (14.0%)
	Stage 2a	1(2.3%)
	Stage 2b	1 (2.3%)
	Stage 3a	7 (16.4%)
	Stage 3b	2 (4.7%)
	Stage 3c	22 (51%)
	Stage 4	4 (9.3%)
Peritoneal Reflection Involvement	Yes	4 (20%)
	No	16 (80%)

Table-2. TNM Classification of colorectal cancer[12]

Primary tumor (T)	
TX	Primary tumor cannot be assessed
TO	No evidence of a primary tumor
Tis	Carcinoma in situ, intramucosal carcinoma
T1	Tumor invades the submucosa
T2	Tumor invades the muscularis propria
T3	Tumor invades through the muscularis propria into pericolorectal tissues
T4a	Tumor penetrates to the surface of the visceral peritoneum
T4b	Tumor directly invades or is adherent to other organs or structures
Regional lymph nodes (N)	
NX	Regional lymph nodes cannot be assessed
N0	No regional lymph node metastasis
N1	Metastasis in one to three regional lymph nodes
N1a	Metastasis in one regional lymph node
N1b	Metastasis in two to three regional lymph nodes
N1c	Tumor deposit(s) in the subserosa, mes-entery, or nonperitonealized pericolic or perirectal tissues without regional node metastasis
N2	Metastasis in four or more regional lymph nodes
N2a	Metastasis in four to six regional lymph nodes
N2b	Metastasis in seven or more regional lymph nodes
Distant metastasis (M)	
M0	No distant metastasis
M1	Distant metastasis
M1a	Metastasis to one site or organ without peritoneal metastasis
M1b	Metastasis to two or more sites or organs without peritoneal metastasis
M1c	Metastasis to the peritoneal surface alone or with metastases to other sites or organs

Discussion

The current study analyzed MRI imaging results in individuals with rectal cancer, which were categorized based on important anatomical landmarks, location, and characteristics of rectal masses in accordance with recognized recommendations. The accuracy of AV (anal verge) location in assessing the extent of craniocaudal tumor spread is crucial. Measuring the length of the tumor and its distance from the anal verge is just as precise as measuring sigmoidoscopy. Based on the findings of the current study, this value was obtained in patients at 29.05±69.81 mm. In the T category, the tumor has progressed laterally through the rectal and mesorectal walls and beyond, necessitating an assessment of the rectal wall layers. The mesorectum is rich in fat and houses the blood vessels and lymph nodes surrounding the rectum, visible from the anterior beneath the anterior peritoneal reflection. The mesorectal fascia is a critical landmark for establishing the margin of TME surgery and identifying high-risk patients for local recurrence.[12,13] However, since they are positioned on the dome of the bladder and above the seminal vesicle in men and on the femoral fundus in females at the junction with the rectum, anterior infiltrative masses might penetrate into the anterior peritoneal reflection.[14] According to the findings of our study, an anterior mass of the rectum was observed in four patients' peritoneal reflection.

The tumors spread into the inferior levator chamber and involve the anal sphincter complex. The levator ani muscle, forming the pelvic floor, acts as a hammock on either side of the mesorectum. Its most distal attachment is in the puborectalis area near the anorectal junction and posteriorly, proximal to the tail tip. When the tumor engages the lower rectum inside the infratectal region, the extension can reach into the sphincter complex, engaging both the internal and external sphincters[15] and the space between them. According to our findings, one patient demonstrated invasion of the anal sphincter by a rectal mass.

The tumor's position is usually characterized as the distance between the tumor's lower limit and the AV (anterior vestibular) margin, as well as its presence in the lower, middle, and upper rectum with a maximum craniocaudal length.[16] The lower boundary of the tumor at the anorectal junction (ARJ) was also recorded. According to the latest European Society of Gastrointestinal and Abdominal Radiology (ESGAR) and Society of Abdominal Radiologists (SAR) guidelines, the peripheral location of the tumor should be reported regularly, and the tumor morphology should be clearly explained. Additionally, it is important to note whether the tumor is mucinous or non-mucinous, as mucinous tumors tend to have a poorer prognosis with a higher likelihood of metastasis. Mucinous tumors exhibit distinctive stromal signs in T2-weighted sequences.[17] In the current study, four tumors displaying mucinous features were identified. Regrettably, one patient passed away. The postoperative pathology reports of two patients revealed that their adenocarcinoma masses had been accurately diagnosed.

Al-Sukhni's meta-analysis showed 87%, 75%, and 85% sensitivity, specificity, and accuracy of MRI for T category evaluation.[18] The T category is determined based on the depth of tumor invasion, which frequently corresponds with the center of the wound. Two-dimensional T2 sequences are greater than 80% accurate for differentiating between T2 and T3 tumors,[16] but insufficient for differentiating between T1 and T2 tumors. Our studies revealed that approximately 42% of patients were in the T1 and T2 stages. According to the ESGAR standards, T3 (a-d) subgroups should be routinely reported depending on the degree of extramural distribution to the mesorectal fat.

Our study found that approximately 42% of patients were in Stages T1 and T2. Routine reporting of T3 (a-d) subgroups should be predicated on the degree of extramural distribution to the mesorectal fat, according to ESGAR recommendations. This classification system is based on the fact that tumors with extramural proliferation of more than 5mm (T3c/T3d) have a poor prognosis (survival rate decreases from 85% to 54%) even if the mesorectal fascia (MRF) is not threatened or involved, indicating the need for enhanced treatment.[13,19]

However, there may be a restriction on the distinction between T2 and T3a tumors (less than 1mm of extramural proliferation) due to the tumor encroaching on the fat around the rectum, which can be a tumor or a desmoplastic reaction. The idea is to classify low-signal-intensity spikules as fibrosis (T2) and thicker or more widespread lesions (in mesorectal fat) as tumors.[13] Only one patient in our study was found in this condition when the tumor stage, T3a, was evaluated. T4b tumors are those that invade nearby organs and may exhibit changes in signal intensity similar to those of a rectal tumor. Recent guidelines clarify that invasion of the pelvic floor muscles, pelvic floor, bones, nerves, or ureter is also classified as T4b.[20]

MRI has a high specificity of 94% to rule out MRF involvement. 16 Two-dimensional T2-weighted sequences are accurate for both involved and non-involved MRF decisions, while DWI-MRI sequences are insufficient.[21] In a study of 396 patients, Shihab et al. observed that MRF involvement by nodules was uncommon.[22] Currently, guidelines no longer consider these features as criteria for determining MRF status. However, the existence of suspicious nodules, deposits, or early indications of malignancy (EMVI) near MRFs must be considered in surgical planning.[20]

MRI diagnostic accuracy for category N is lower than for category T.[17] New criteria have been proposed for classifying nodules in metastatic (N+) nodes, and these are based on the size and morphology of the nodule. The guidelines recommend using these common criteria. Node properties rely on two-dimensional images obtained with T2-weighted and DWI-MRI, but these imaging techniques are not accurate for distinguishing between N+ and N0 nodes.[23] The new nodal criteria are useful for describing mesorectal nodules but can also be applied to extra-sensory nodules. The Eighth Edition of the American Joint Committee on Cancer (AJCC) categorizes the N category into N0, N1, and N2 based on the number of nodes without specifying their location.[24] Our findings reveal that the majority of patients were in stage N2 at the time of imaging.

Microscopic as well as macroscopic spread of the tumor in the peripheral arteries reduces overall survival and is associated with distant metastasis and local recurrence. EMMI, as a tumor medial signal, replaces the vascular flow vacuole as the vessel enlarges and its lines become irregular. 21 MRI has a high sensitivity (96%) for detecting macroscopic EMVI (in images with T2-weighted sequences but not in DWI) and can be utilized to improve therapy.[25-27] Only two patients in this study showed evidence of EMVI involvement in imaging.

Some limitations of the current study include its single-center design and the brief duration of the study, as well as the relatively small sample size.

Conclusions

The findings of the current study suggest that high-resolution MRI examinations can accurately determine regional staging, which is essential for optimizing treatment. Managing rectal cancer is a complex process that requires a multidisciplinary approach. Recent advances in rectal cancer imaging allow the radiologist to play a crucial role in supporting optimal management during both initial assessment and follow-up exams. Standardized reporting templates can facilitate the transmission of precise information.

Acknowledgment

The authors thank and appreciate all staff of the sonography and radiology clinic of Golestan and Eizadi in Gorgan and Golestan University of Medical Sciences.

Competing interests

The authors declare that they have no competing interests.

Abbreviations

PACS: Picture Archiving and Communication System; CRC: Colorectal Cancer; MRI: Magnetic Resonance Imaging; LN: Lymph Node; DWI: Diffusion-weighted imaging; AV: Anal Verge; Endoscopic Ultrasound: EUS; ARJ: Anorectal Junction; ESGAR: European Society of Gastrointestinal and Abdominal Radiology; SAR: Society of Abdominal Radiologists; MRF: Mesorectal Fascia; AJCC: American Joint Committee on Cancer; TME: Total Mesorectal Excision.

Authors' contributions

DN.N drafted the manuscript, contributed to the conception, and performed the analytic calculations and interpretation of data. MH.G collaborate on MRI imaging and clinical data and interpretation of data. N.N conceived of the presented idea, collected data management, designed the study, and critically revised the analysis and manuscript. F.M designed the statistical model, the computational framework. All authors read and approved the final manuscript. All authors take responsibility for the integrity of the data and the accuracy of the data analysis.

Funding

This project was financially supported by the deputy of research and technology of Golestan University of Medical Sciences. The funding body was not involved in the design of the study or collection, analysis, and interpretation of data or writing of this manuscript.

Role of the funding source

None.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

Ethical approval for this study was obtained from the Ethics and Research Committee of Golestan University of Medical Sciences (IR.GOUMS.REC.1400.202). The guidelines on research involving the use of human subjects (beneficence, non-maleficence, veracity, confidentiality, and voluntarism) were strictly adhered to according to the Helsinki Declaration.

Consent for publication

By submitting this document, the authors declare their consent for the final accepted version of the manuscript to be considered for publication.

References

1. Rompianesi G, Pegoraro F, Ceresa CD, Montalti R, Troisi RI. Artificial intelligence in the diagnosis and management of colorectal cancer liver metastases. World J Gastroenterol. 2022; 28(1):108.
2. Kang SI, Kim DW, Cho JY, Park J, Lee KH, Son IT, et al. Is MRI of the liver needed during routine preoperative workup for colorectal Cancer?. Dis Colon Rectum. 2017;60(9):936-44. doi:10.1097/DCR.0000000000000914
3. Lavdas I, Rockall AG, Daulton E, Kozlowski K, Honeyfield L, Aboagye EO, et al. Histogram analysis of apparent diffusion coefficient from whole-body diffusion-weighted MRI to predict early response to chemotherapy in patients with metastatic colorectal cancer: preliminary results. Clin Radiol. 2018;73 (9):832-e9. doi:10.1016/j.crad.2018.04.011
4. Pourahmad S, Pourhashemi S, Mohammadianpanah M. Colorectal cancer staging using three clustering methods based on preoperative clinical findings. Asian Pac J Cancer Prev. 2016; 17(2):823-7. doi:10.7314/APJCP.2016.17.2.823
5. Taylor SA, Mallett S, Beare S, Bhatnagar G, Blunt D, Boavida P, et al. Diagnostic accuracy of whole-body MRI versus standard imaging pathways for metastatic disease in newly diagnosed colorectal cancer: the prospective Streamline C trial. Lancet Gastroenterol Hepatol. 2019;4 (7): 529-37. doi:10.3310/hta23660
6. Odalovic S, Stojiljkovic M, Sobic-Saranovic D, Pandurevic S, Brajkovic L, Milosevic I, et al. Prospective study on diagnostic and prognostic significance of postoperative FDG PET/CT in recurrent colorectal carcinoma patients: comparison with MRI and tumor markers. Neoplasma. 2017; 64(6):954-61. doi:10.4149/neo_2017_613
7. Ahmad Ea, Nehal Km, Mohamed Ae, Mohamed Zm. Role of Diffusion-Weighted MRI in Colorectal Cancer. Med J Cairo Univ. 2019;87(June):1631-7. doi:10.21608/mjcu.2019.53892
8. Park JS, Jang YJ, Choi GS, Park SY, Kim HJ, Kang H, et al. Accuracy of preoperative MRI in predicting pathology stage in rectal cancers: node-for-node matched histopathology validation of MRI features. Dis Colon Rectum. 2014;57(1):32-8. doi:10.1097/DCR.0000000000000004
9. Kang B, Lee JM, Song YS, Woo S, Hur BY, Jeon JH, et al. Added value of integrated whole-body PET/MRI for evaluation of colorectal cancer: comparison with contrast-enhanced MDCT. Am J Roentgenol. 2016; 206(1):W10-20. doi:10.2214/AJR.14.13818
10. Jung EJ, Ryu CG, Kim G, Kim SR, Nam SE, Park HS, et al. Is rectal MRI beneficial for determining the location of rectal cancer with respect to the peritoneal reflection?. Radiol Oncol. 2012;46(4):296. doi:10.2478/v10019-012-0038-7
11. Lehtonen TM, Koskenvuo LE, Seppälä TT, Lepistö AH. The prognostic value of extramural venous invasion in preoperative MRI of rectal cancer patients. Colorectal Dis. 2022. doi:10.1111/codi.16103
12. Niknam N, Kalteh EA, Charkazi A. The burden of premature mortality due to colorectal cancer in Golestan province from 2011-2015: a sequential cross-sectional study. Stud Med Sci. 2019; 30(5):373-80.
13. Kalisz KR, Enzerra MD, Paspulati RM. MRI evaluation of the response of rectal cancer to neoadjuvant chemoradiation therapy. Radiographics. 2019;39(2):538-56. doi:10.1148/rg.2019180075
14. Ludwig DR, Mintz AJ, Sanders VR, Fowler KJ. Liver imaging for colorectal cancer metastases. Curr Colorectal Cancer Rep. 2017; 13 (6):470-80.
15. Cleary RK, Morris AM, Chang GJ, Halverson AL. Controversies in surgical oncology: does the minimally invasive approach for rectal cancer provide equivalent oncologic outcomes compared with the open approach?. Ann Surg Oncol. 2018;25(12): 3587-95. doi:10.1245/s10434-018-6740-y
16. Platt E, Dovell G, Smolarek S. Systematic review of outcomes following pelvic exenteration for the treatment of primary and recurrent locally advanced rectal cancer. Tech Coloproctol. 2018; 22(11):835-45. doi:10.1007/s10151-018-1883-1
17. Beets-Tan RG, Lambregts DM, Maas M, Bipat S, Barbaro B, Curvo-Semedo L, et al. Magnetic resonance imaging for clinical management of rectal cancer: updated recommendations from the 2016 European Society of Gastrointestinal and Abdominal Radiology (ESGAR) consensus meeting. Eur Radiol. 2018; 28 (4): 1465-75. doi:10.1007/s00330-017-5026-2
18. Al-Sukhni E, Milot L, Fruitman M, Beyene J, Victor JC, Schmocker S, et al. Diagnostic accuracy of MRI for assessment of T category, lymph node metastases, and circumferential resection margin involvement in patients with rectal cancer: a systematic review and meta-analysis. Ann Surg Oncol. 2012;19 (7): 2212-23. doi:10.1245/s10434-011-2210-5
19. Kennedy ED, Simunovic M, Jhaveri K, Kirsch R, Brierley J, Drolet S, et al. Safety and feasibility of using magnetic resonance imaging criteria to identify patients with "good prognosis" rectal cancer eligible for primary surgery: the phase 2 nonrandomized QuickSilver clinical trial. JAMA Oncol. 2019;5(7):961-6.

doi:10.1001/jamaoncol.2019.0186

20. Taylor FG, Quirke P, Heald RJ, Moran B, Blomqvist L, Swift I, et al. Preoperative high-resolution magnetic resonance imaging can identify good prognosis stage I, II, and III rectal cancer best managed by surgery alone: a prospective, multicenter, European study. Ann Surg. 2011;253(4):711-9. doi:10.1097/SLA.0b013e31820b8d52
21. Gollub MJ, Lall C, Lalwani N, Rosenthal MH. Current controversy, confusion, and imprecision in the use and interpretation of rectal MRI. Abdom Radiol. 2019; 44 (11): 3549-58. doi:10.1007/s00261-019-01996-3
22. Nougaret S, Reinhold C, Mikhael HW, Rouanet P, Bibeau F, Brown G. The use of MR imaging in treatment planning for patients with rectal carcinoma: have you checked the "DISTANCE"?. Radiology. 2013;268(2):330-44. doi:10.1148/radiol.13121361
23. Shihab OC, Quirke P, Heald RJ, Moran BJ, Brown G. Magnetic resonance imaging-detected lymph nodes close to the mesorectal fascia are rarely a cause of margin involvement after total mesorectal excision. J Br Surg. 2010;97(9):1431-6. doi:10.1002/bjs.7116
24. Beets-Tan RG, Lambregts DM, Maas M, Bipat S, Barbaro B, Caseiro-Alves F, et al. Magnetic resonance imaging for the clinical management of rectal cancer patients: recommendations from the 2012 European Society of Gastrointestinal and Abdominal Radiology (ESGAR) consensus meeting. Eur Radiol. 2013;23(9):2522-31. doi:10.1007/s00330-013-2864-4
25. Amin MB, Greene FL, Edge SB, Compton CC, Gershenwald JE, Brookland RK, et al. The eighth edition AJCC cancer staging manual: continuing to build a bridge from a population-based to a more "personalized" approach to cancer staging. CA: Cancer J Clin. 2017;67(2):93-9. doi:10.3322/caac.21388
26. Schaap DP, Ogura A, Nederend J, Maas M, Cnossen JS, Creemers GJ, et al. Prognostic implications of MRI-detected lateral nodal disease and extramural vascular invasion in rectal cancer. J Br Surg. 2018;105(13):1844-52. doi:10.1002/bjs.10949
27. Prampolini F, Taschini S, Pecchi A, Sani F, Spallanzani A, Gelsomino F, et al. Magnetic resonance imaging performed before and after preoperative chemoradiotherapy in rectal cancer: predictive factors of recurrence and prognostic significance of MR-detected extramural venous invasion. Abdom Radiol. 2020; 45(10):2941-9. doi:10.1007/s00261-018-1838-z

Cite this article as:
Najafi N, Gharib MH, Nematollahi N, Mehravar F. Preoperative evaluation of pelvic MRI findings in patients with rectosigmoid cancer in Golestan province (north of Iran). Novel Clin Med. 2022; 1(3):127-134. doi: 10.22034/NCM.2022.337938.1041