



Prone and Supine Positioning in Magnetic Resonance Enterography: A Prospective Evaluation of Examination Duration, Bowel Distension, Artefacts and Patient Tolerance

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Abstract

Background/Aim: Magnetic resonance enterography (MRE) is a well-established imaging technique for evaluating the small bowel. Traditionally, examinations have been performed in the prone position based on the assumption that anterior abdominal compression improves bowel loop separation and reduces motion artefact from the anterior abdominal wall. However, the supine position may improve patient comfort and compliance. The aim of this study was to evaluate the impact of prone and supine positions on image quality and patient tolerance during routine MRE.

Methods: This prospective observational study included 60 adult patients undergoing MRE. Thirty patients were examined in the supine position and 30 in the prone position. All examinations were performed on a 1.5 T magnetic resonance system following a standard institutional protocol. The analysis included bowel distension, image artefacts, examination duration and patient tolerance.

Results: No significant difference in examination duration was found between the two groups ($p = 0.161$). Prone positioning led to significantly better distension in the ileal segments ($p < 0.05$) and resulted in fewer artefacts in specific bowel segments. However, patients examined in the supine position reported significantly lower levels of claustrophobic discomfort ($p = 0.043$).

Conclusion: Although MRE in the prone position provides superior small-bowel distention, the supine position is better tolerated by patients and offers a more stable examination, without significantly compromising diagnostic quality. Examinations in the prone and supine positions should be selected according to the individual patient and their clinical circumstances.

Key words: Magnetic resonance enterography; Patient positioning; Prone positioning; Supine positioning; Small bowel; Imaging.

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Introduction

Magnetic resonance enterography (MRE) combines MR scanning of the small bowel after administration of oral contrast to distend the small bowel loops.¹ Over the past two decades, MRE has

become a standard imaging technique for evaluating small bowel diseases, particularly in patients with chronic inflammatory disorders who require repeated follow-up examinations over many years.

MRE offers several advantages over other imaging techniques, including excellent soft-tissue contrast, multiplanar capability and the absence of ionising radiation. In addition to visualising the small bowel wall, it enables evaluation of mesenteric vascularity, surrounding inflammatory changes, fistulas, abscesses and lymph node involvement within a single examination.² These features make MRE particularly suitable for younger patients and those requiring long-term follow-up.³ MRE is now widely considered the preferred imaging technique for many clinical scenarios, but the most common reason to perform MRE is to diagnose, monitor and detect complications of IBD.⁴

To achieve a high success rate in MRE, it is essential to use the appropriate technique.⁵ Patients can be scanned in either supine or prone position, but body positioning during acquisition remains one of the most crucial and inconsistent elements of the examination protocol.

Traditionally, MRE has been performed in the prone position. This is based on the assumption that mild anterior abdominal compression improves the separation of bowel loops, particularly in the jejunum.⁶ The prone position also reduces the effects of respiratory motion on the anterior abdominal wall. Cronin et al achieved a more uniform distribution of orally administered contrast material,⁷ which is very important because MRE relies on sufficient bowel distention.⁸

Compression of the anterior abdominal wall in the prone position effectively reduces the patient's anteroposterior (AP) diameter. This reduction decreases the number of slices needed in the coronal plane, which is probably the most important plane in performing MRE. Reducing the number of slices not only reduces the overall examination time but also minimises motion-related blurring artefacts.⁹

For an extended period, prone acquisition was routinely included in examination protocols. Many centres viewed the prone position as standard practice, rather than as a flexible technical option. However, clinical experience has shown that not all patients may tolerate prone positioning well.

Many patients do not tolerate prolonged prone positioning well. Abdominal pressure, reduced respiratory movement and musculoskeletal strain can result in irregular breathing and increased motion artefacts. This may undermine the theoretical benefits of this positioning. Some institutions subsequently adopted the supine position as an alternative approach.¹⁰

Some patients, especially those with stoma bags, postoperative scars, or limited mobility, find the supine position to be more comfortable. For both children and adults undergoing MRE under general anaesthesia, positioning them supine enables effective anaesthesia monitoring. In some cases, when conducting MRE in the paediatric population, audiovisual aids may be necessary to reduce fear and restlessness. In these situations, the supine position is essential, as it allows optimal equipment placement and facilitates interaction with the child.¹¹

Supine positioning may enhance patient comfort, aids communication during the examination and lead to less disturbance, particularly for older individuals, those with a higher body mass index, or patients with painful musculoskeletal conditions. However, there are still some theoretical concerns associated with this position. For instance, bowel loops may overlap more significantly in the anterior abdominal cavity, making it more difficult to clearly view the proximal segments of the small intestine.

Published evidence comparing prone and supine MRE remains limited and inconsistent, especially when patient tolerance becomes a limiting factor.¹² This issue is clinically important because the quality of images obtained in MRE is affected not only by bowel distension and imaging sequence parameters, but also by the patient's cooperation and their ability to maintain regular breathing.

Despite the long-standing use of both approaches, there is still no definitive answer on which approach should be routinely preferred. This study aimed to analyse, under typical clinical conditions, whether body position affects on technical image quality and patient comfort during MRE.

Methods

This prospective clinical study was conducted over a 12-month period from November 2021 to November 2022. The study was approved by the Ethics Committee and written informed consent was obtained from all participants. A total of 60 consecutive adult patients (30 women, 30 men, mean age 42.5 years (range 19-81), referred for MRE due to known or suspected small bowel disease, were included. Patients were divided into two equal groups based on body position during image acquisition: 30 patients were examined in the supine position and 30 were in the prone position, in accordance with the standard institutional acquisition protocol. The aim of the study was to compare technical image quality and examination tolerance under routine clinical conditions.

Inclusion criteria were age ≥ 18 years and written informed consent. Exclusion criteria included pregnancy, contraindications to intravenous contrast administration, severe claustrophobia, an inability to tolerate the examination procedure and refusal to participate. Before MRE, baseline demographic data were recorded. Participants' tolerance to the examination was assessed using a structured, anonymous questionnaire created specifically for this study.

The questionnaire included five Likert-scale items that assessed subjective discomfort, before, during and after the examination. Responses were graded on a five-point scale: 1 indicated no discomfort; 2: mild discomfort; 3: moderate discomfort; 4: severe discomfort; and 5: intolerable discomfort. Claustrophobic discomfort was assessed using a four-point Likert scale: 1 indi-

cated no discomfort; 2: mild discomfort; 3: moderate discomfort; and 4: severe discomfort.

Analysis focused on bowel distension and artifact presence was conducted by a single senior radiologist. Small bowel distension was assessed separately for each bowel segment using a three-point ordinal scale: 1 indicated adequate luminal distension; 2 indicated suboptimal distension, with images retaining diagnostic value; and 3 indicated inadequate distension, with images considered non-diagnostic.

The presence and severity of image artifacts were assessed separately for each small-bowel segment using a three-point ordinal scale: 1 indicated the absence of artifacts; 2 indicated moderate artifacts, with images retaining diagnostic value; and 3 indicated extensive artifacts, with images considered non-diagnostic. All scores were compared between participants examined in the supine and prone positions.

All examinations were performed on a 1.5 T MRI system Magnetom Avanto Fit (Siemens Healthineers) using high-performance gradient coils and a multi-channel body coil configuration (Table 1). All patients were fasted for a minimum six hours prior to imaging. Bowel distention was achieved by oral administration of 1200 mL of water mixed with 300 mL of mannitol over approximately 60 minutes. The bladder was emptied prior to imaging. Intravenous access was achieved and an antiperistaltic agent was administered immediately before the motion-sensitive sequences were initiated. Gadolinium-based contrast was administered intravenously according our standard departmental protocol.

Table 1: Magnetic resonance enterography (MRE) sequence parameters and imaging protocol on the magnetic resonance imaging (MRI) Magnetom Avanto Fit (Siemens Healthineers) 1.5 Tesla

Parameter	Slices	Df	Pho	Fr	Fph	St	TR	TE	Av	C
Localiser HASTE	5	150 %	30 %	500 mm	100 %	6.0 mm	1200 ms	90 ms	1	1
T2 haste fs cor thick sl p2 384 bh	1	50	50	500	100	50	4500	751	1	1
Dynamic coronal acquisition	1	20	0	440	93.8	6	36.01	1.18	1	21
Spasmolytic administration										
T1 vibe fs tra p4 bh 320 NATIV	1	20	0	330	75.0	4.0	3.67	1.22	1	1
T1 vibe fs cor p4 bh 320 NATIV	1	20	21	482	71.9	1.8	3.22	1.44	1	1
Contrast application										
T1 vibe fs cor p4 bh 320 KS 25 s	1	20	21	482	71.9	1.8	3.22	1.44	1	1
T1 vibe fs cor p4 bh 320 KS 60 s	1	20	21	482	71.9	1.8	3.22	1.44	1	1

T1 vibe fs tra p4 bh 320 KS										
T1 vibe fs cor p4 bh 320 KS 3 min	1	20	21	482	71.9	1.8	3.22	1.44	1	1
Ep2d diff b50 400 800 tra p2 trig	58	40	0	380	80.6	5.0	7500	57		1
T2 haste cor p2	42	10	0	470	81.3	4.0	1400	80	1	4
T2 haste tra p2 mbh 320	80	30	0	380	81.3	4.0	1400	95	1	2
T2 haste tra fs p2 mbh 320	80	30	0	380	81.3	4.0	1400	95	1	2

The imaging protocol was the same for both groups and included the following sequences: localiser sequences, coronal thick-slab T2-weighted HASTE images, dynamic coronal cine acquisitions, as well as native and post-contrast fat-suppressed T1-weighted VIBE sequences in both coronal and axial planes and diffusion-weighted imaging.

Data were collected from the institutional *Radiology Information System* and the *PACS* archive. Statistical analysis was conducted using SPSS software. A p-value of less than 0.05 was considered statistically significant.

Results

Comparison of MRE examination duration: supine vs prone positioning

The mean examination duration did not differ significantly between the two groups. For patients in the supine position, the average acquisition time was 14.01 ± 0.52 minutes, whereas those in the prone position had an average duration of 13.98 ± 0.40 minutes. Distribution analysis indicated that both groups showed no significant deviation from normality, allowing a parametric comparison of mean values.

An independent-samples t-test showed no statistically significant difference in examination duration between the supine and prone positions ($t(58) = 1.439$, $p = 0.161$), indicating that patient positioning does not influence overall acquisition time under standardised conditions. The median values were also closely aligned, with the supine group averaging 14.16 minutes and the prone group averaging 14.11 minutes. The observed ranges also overlapped, ranging 13.05–14.59 minutes for the supine group and 13.22–14.54 minutes for the prone group. These findings indicate that the patient's positioning did not significantly affect the total acquisition time during routine clinical conditions (Table 2).

Table 2: Examination time in the supine and prone groups

Position	Mean	Median	SD	Minimum	Maximum
Supine	14.01	14.16	0.52	13.05	14.59
Prone	13.98	14.11	0.40	13.22	14.54

SD: standard deviation;

Difference in small bowel distension between supine and prone positioning

An assessment of bowel distension revealed segment-dependent variations between the two examination positions. No statistically significant differences were found at the level of the duodenum ($p = 0.165$), proximal jejunum ($p = 0.052$), or distal jejunum ($p = 0.087$). However, there was a trend toward better luminal expansion in the prone group for the proximal jejunum.

In contrast, significant differences were found in the ileal segments. Prone positioning was related to a greater distension in both the proximal ileum (Mann-Whitney $U = 360$, $p = 0.010$) and distal ileum (Mann-Whitney $U = 374.5$, $p = 0.045$). The results indicate that the body position significantly affects bowel distension, particularly in the ileal region of the small intestine (Table 3, Figure 1).

Difference in image artefacts between supine and prone positioning

Evaluation of image artefacts revealed that the impact of body position varied among individual segments of the small bowel. A statistically significant difference was observed between supine and prone positioning in the duodenum and proximal or distal ileum. Specifically, prone acquisition was associated with a lower artifact burden and, consequently, better image quality ($p = 0.005$).

In contrast, no significant differences were observed in the proximal ($p = 0.470$) or distal ($p = 0.440$) jejunum, indicating that patient positioning had no measurable effect on artifact occurrence in these segments. In terms of image quality, prone positioning resulted in fewer artefacts in selected bowel segments, particularly in the ileal regions. However, no significant differences were observed in the jejunal segments (Table 4).

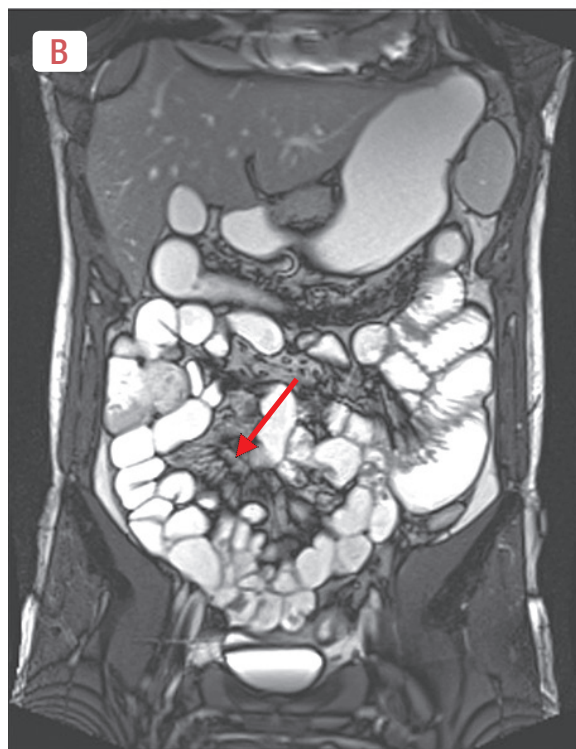
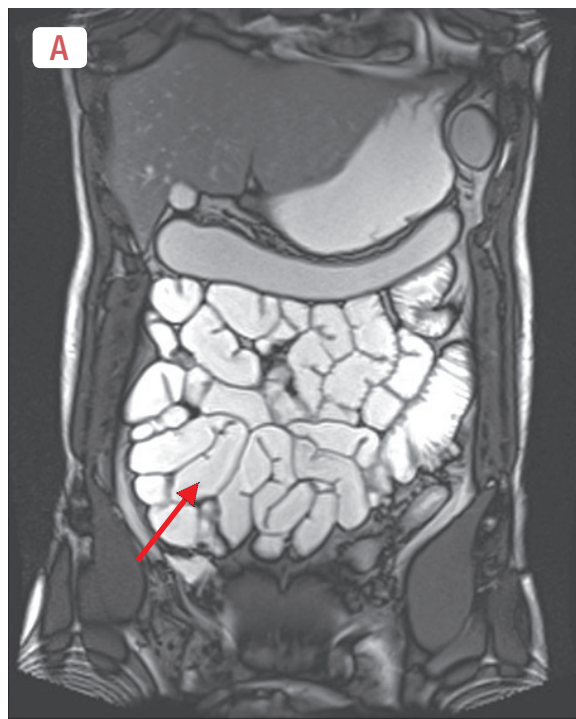


Figure 1: Magnetic resonance enterography demonstrating differences in small-bowel distension according to patient position. (A) Examination performed in the prone position shows adequate distension of the small-bowel loops, including the distal ileal loops (arrow). (B) Examination performed in the supine position shows inadequate distension with partial collapse of the distal ileal loops (arrow)

Table 3: Comparison of bowel distension between supine and prone positioning across different small bowel segments

Segment	Position	N	Mean rank	Mann-Whitney U	p-value
Duodenum	Supine	30	32.00	405.0	0.165
	Prone	30	29.00		
Proximal jejunum	Supine	30	34.42	332.5	0.052
	Prone	30	26.58		
Distal jejunum	Supine	30	33.88	348.5	0.087
	Prone	30	27.12		
Proximal ileum	Supine	30	33.50	360.0	0.010
	Prone	30	27.50		
Distal ileum	Supine	30	33.02	374.5	0.045
	Prone	30	27.98		

Table 4: Relationship between body position and the presence of artifacts in small-bowel segments

Segment	Position	N	Mean rank	Mann-Whitney U	p-value
Duodenum	Supine	30	34.00	345.00	0.005
	Prone	30	27.00		
Proximal jejunum	Supine	30	29.07	407.00	0.470
	Prone	30	31.93		
Distal jejunum	Supine	30	31.95	406.50	0.440
	Prone	30	29.05		
Proximal ileum	Supine	30	34.00	345.00	0.005
	Prone	30	27.00		
Distal ileum	Supine	30	34.00	375.00	0.005
	Prone	30	27.00		

Difference in subjective comfort between supine and prone positioning

There were no statistically significant differences between the supine and prone groups regarding patient-reported nausea and abdominal discomfort during bowel preparation. The median responses were similar across groups and the Mann-Whitney analysis indicated no significant difference in subjective tolerance to oral preparation ($U = 401.0$, $p = 0.443$). These findings indicate that body position during MRE does not affect subjective gastrointestinal discomfort during pre-examination preparation (Table 5).

Table 5: Difference between participants according to body position in relation to their responses to the statement “Feeling of nausea and other abdominal discomfort during preparation”

Position	N	Mean rank	Mann-Whitney U	p-value
Supine	30	32.13	401.00	0.443
Prone	30	28.87		

Difference in claustrophobic discomfort between supine and prone positioning

A statistically significant difference was found in the levels of claustrophobic discomfort reported by patients during image acquisition. Patients in the prone position experienced greater fear of confined spaces than those in the supine position (Mann-Whitney U = 330.0, p = 0.043). This finding indicates that the prone position may lead to lower subjective tolerance during scans, particularly for patients prone to claustrophobia (Table 6).

Table 6: The difference in participants' levels of claustrophobic discomfort across body positions

Position	N	Mean rank	Mann-Whitney U	p-value
Supine	30	26.50	330.00	0.043
Prone	30	34.50		

Discussion

MRE has become one of the most widely accepted imaging techniques for evaluating small bowel diseases, especially in patients with inflammatory bowel disorders who require repeated imaging follow-ups.^{13, 14} Its diagnostic value comes from its excellent soft-tissue contrast, its ability to produce images in multiple planes and its lack of ionising radiation.¹⁵ Despite the increasing standardisation of imaging protocols, various technical aspects of the examination can vary between institutions. One of the most debated aspects is patient positioning.

Presented study investigated how lying in a supine or prone position affects key aspects of MRE, including examination duration, bowel distension, image artefacts and patient comfort. Results demonstrate that the overall examination duration was similar across both positions, with no statistically significant difference in acquisition time. Positioning does not significantly affect MRE workflow time if standardised acquisition protocols are used. Similar results have been reported in previous studies, indicating that the length of an MRE is primarily influenced by sequence parameters and patient cooperation rather than body position itself.¹⁶

Proper bowel distention is key to preventing both false-positive and false-negative results during

an MRE examination. In presented analysis, it was found segment-specific variations in the bowel distension. Although there was no statistically significant difference in distension between the duodenal and jejunal segments, positioning the patient prone significantly improved luminal distension in both the proximal and distal ileum. Adequate bowel distension is essential for accurate interpretation of MRE, as insufficient luminal expansion can obscure mural abnormalities and diminish diagnostic confidence.¹⁷

The increased distension of the ileum seen in the prone position may be due to the slight anterior abdominal compression that occurs in this position, which helps separate bowel loops and allows for a more uniform distribution of intraluminal contrast. Maccioni et al reported that, in the surveillance of patients with Peutz-Jeghers syndrome (PJS), a combination of supine and prone positions was significantly more accurate than the supine position alone for detecting polyps smaller than 15 mm.¹⁸

In the artefacts analysis it was observed a similar effect concerning patient positioning. In presented cohort, using a prone position resulted in significantly fewer artefacts in both the duodenum and ileal segments, while no notable differences were observed in the jejunum. These results likely reflect the interaction between bowel motion, respiratory mechanics and coil positioning. The prone position may help stabilise the anterior abdominal wall, thereby reducing motion-related artefacts in specific bowel segments. Previous technical assessments of MRE have highlighted that motion artefacts remain a major limitation of this imaging method and can significantly affect image interpretation, especially in the distal small bowel segments.¹⁹

Presented findings show that body position does not significantly affect subjective gastrointestinal discomfort related to bowel preparation. This suggests that the main factors contributing to discomfort during the preparation process are the ingestion of oral contrast and pharmacological bowel relaxation, rather than the imaging position.

A significant difference was found in patients' report of claustrophobic discomfort during scanning, based on their positioning. The patients in the prone group had a significantly greater claustrophobic discomfort during the study than the

patients in the supine group. This finding has strong clinical implications as patient tolerance during the examination is crucial for obtaining good-quality images and completing the examination successfully. Previous studies have also shown that lying in a supine position can enhance patient comfort and cooperation during MRI scans, particularly for individuals who are prone to claustrophobia.²⁰

Findings indicate that patient positioning during MRE affects results depending on various factors and the specific segment being examined. Prone positioning provides clear technical advantages, such as improved bowel distension and fewer artefacts in distal small bowel segments. On the other hand, supine positioning may enhance patient comfort and tolerance during scanning. These findings are consistent with existing literature, which suggests that both positions are generally acceptable in routine clinical practice.²¹ The optimal positioning approach may depend on the specific diagnostic goals and individual patient characteristics. Prone positioning is more commonly used than supine positioning, but additional research is needed to better understand the balance between patient comfort and the detection rate of pathology.

The current study has several limitations that should be acknowledged. First, the relatively small sample size may limit the generalisability of the findings. Second, the study was conducted at a single institution using a single MRI platform and acquisition protocol, which may limit its applicability to other technical settings. Limitations of this study also included our inability to blind the observers to the patient's position. Despite these limitations, the prospective design and standardised imaging protocol strengthen the validity of the findings and support their applicability in routine clinical practice.

This study demonstrates that patient positioning in MRE has a segment-dependent impact on image quality and significantly influences patient tolerance. While prone positioning improves ileal distension and reduces artefacts in selected segments, the supine position offers superior patient comfort. Patient positioning in MRE should be based on the clinical context, the patient's condition and practical considerations instead of following a strict technical standard.

Conclusion

Based on presented findings, prone positioning improves bowel distension in ileal segments and reduces artefacts, while supine positioning enhances patient tolerance. In routine clinical practice, patient positioning in MRE should be individualised and based on clinical context, the patient's condition and practical considerations, rather than adhering to a rigid technical standard. Future multicentre studies involving larger patient populations may provide more clarity on the best positioning strategies for different clinical situations.

Ethics

The study was approved by the Ethics Committee of the Faculty of Medicine, University of Banja Luka (No 18/4.245/22, dated 22 September 2022) and the Ethics Committee of the University Clinical Centre of the Republic of Srpska (No 01-19-447-2/21, dated 20 October 2021). Written informed consent was obtained from all participants.

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Conflicts of interest

The authors declare that there is no conflict of interest.

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Data access

The data that support the findings of this study are available from the corresponding author upon reasonable individual request.

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References

- Vujnović S, Rančić S. [Modern diagnostics of small and large bowel diseases. In: Šaranović Đ, editor. *Fundamentals of Digestive Radiology*]. Paraćin/Beograd: Nova artija Naučna KMD; 2025. p. 176–94. Serbian.
- Bruining DH, Zimmermann EM, Loftus EV Jr, Sandborn WJ, Sauer CG, Strong SA; Society of Abdominal Radiology Crohn's Disease-Focused Panel. Consensus recommendations for evaluation, interpretation, and utilization of computed tomography and magnetic resonance enterography in patients with small bowel Crohn's disease. *Radiology*. 2018 Mar;286(3):776–79. doi: 10.1148/radiol.2018171737.
- Panes J, Bouhnik Y, Reinisch W, Stoker J, Taylor SA, Baumgart DC, et al. Imaging techniques for assessment of inflammatory bowel disease: joint ECCO and ESGAR evidence-based consensus guidelines. *J Crohns Colitis*. 2013 Aug;7(7):556–85. doi: 10.1016/j.crohns.2013.02.020.
- Guglielmo FF, Roth CG, Mitchell DG. MR and CT imaging techniques of the bowel. In: *Cross-Sectional Imaging in Crohn's Disease*. Berlin: Springer; 2019. p. 49–75.
- Álvarez-Cofiño Tuñón A, da Silva Torres M, Fernández Del Valle A, Noriega Menéndez P, Menéndez de Llano Ortega R, González Filgueira P. Contrast agents for MR enterography. *Radiologia (Engl Ed)*. 2024 Oct;66 Suppl 2:S89–S97. doi: 10.1016/j.rxeng.2024.10.002.
- Chatterji M, Fidler JL, Taylor SA, Anupindi SA, Yeh BM, Guglielmo FF. State of the art MR enterography technique. *Top Magn Reson Imaging*. 2021;30(1):3–11. doi: 10.1097/RMR.0000000000000263.
- Cronin CG, Lohan DG, Mhuirheartaigh JN, McKenna D, Alhajeri N, Roche C, et al. MRI small-bowel follow-through: prone versus supine patient positioning for best small-bowel distention and lesion detection. *AJR Am J Roentgenol*. 2008;191(2):502–6. doi: 10.2214/AJR.07.2338.
- Gourtsoyiannis N, Papanikolaou N, Grammatikakis J, Prassopoulos P. MR enteroclysis: technical considerations and clinical applications. *Eur Radiol*. 2002 Nov;12(11):2651–8. doi: 10.1007/s00330-002-1507-y.
- Vujnović S. [Magnetic resonance enterography in the diagnosis of small bowel diseases]. Banja Luka: Medicinski fakultet Univerziteta u Banjoj Luci; 2025. Serbian.
- Taylor SA, Avni F, Cronin CG, Hoeffel C, Kim SH, Laghi A, et al. The first joint ESGAR/ESPR consensus statement on the technical performance of cross-sectional small bowel and colonic imaging. *Eur Radiol*. 2017 Jun;27(6):2570–82. doi: 10.1007/s00330-016-4615-9.
- Mollard BJ, Smith EA, Dillman JR. Pediatric MR enterography: technique and approach to interpretation—how we do it. *Radiology*. 2015 Jan;274(1):29–43. doi: 10.1148/radiol.14122449.
- Rimola J, Ordás I, Rodriguez S, García-Bosch O, Aceituno M, Llach J, et al. Magnetic resonance imaging for evaluation of Crohn's disease: validation of parameters of severity and quantitative index of activity. *Inflamm Bowel Dis*. 2011 Aug;17(8):1759–68. doi: 10.1002/ibd.21551.
- Amzallag-Bellenger E, Oudjit A, Ruiz A, Cadot G, Soyer PA, Hoeffel CC. Effectiveness of MR enterography for the assessment of small-bowel diseases beyond Crohn disease. *Radiographics*. 2012 Sep–Oct;32(5):1423–44. doi: 10.1148/rg.325115088.
- Pierro A, Minordi LM, Larosa L, Guerri G, Grimaldi A, Quinto F, et al. Small bowel imaging from stepchild of roentgenology to MR enterography: Part I: guidance in performing and observing normal and abnormal imaging findings. *Life (Basel)*. 2023 Aug 5;13(8):1691. doi: 10.3390/life13081691.
- Garg HK, Shashi KK, Kurian J, Winant AJ, Lee EY. MR enterography: beyond inflammatory bowel disease. *Radiol Clin North Am*. 2025 Sep;63(5):781–89. doi: 10.1016/j.rcl.2025.03.011.
- Griffin N, Grant LA, Anderson S, Irving P, Sanderson J. Small bowel MR enterography: problem solving in Crohn's disease. *Insights Imaging*. 2012 Jun;3(3):251–63. doi: 10.1007/s13244-012-0154-3.
- Schmidt SA, Baumann JA, Stanescu Siegmund N, Froehlich E, Brambs HJ, et al. Oral distension methods for small bowel MRI: comparison of different agents to optimize bowel distension. *Acta Radiol*. 2016 Dec;57(12):1460–67. doi: 10.1177/0284185116631183.
- Maccioni F, Al Ansari N, Mazzamurro F, Barchetti F, Marini M. Surveillance of patients affected by Peutz-Jeghers syndrome: diagnostic value of MR enterography in prone and supine position. *Abdom Imaging*. 2012;37:279–87. doi: 10.1007/s00261-011-9739-4.
- Sinha R, Murphy P, Sanders S, Ramachandran I, Hawker P, Rawat S, et al. Diagnostic accuracy of high-resolution MR enterography in Crohn's disease: comparison with surgical and pathological specimen. *Clin Radiol*. 2013 Sep;68(9):917–27. doi: 10.1016/j.crad.2013.02.012.
- Leyendecker JR, Bloomfeld RS, DiSantis DJ, Waters GS, Mott R, Bechtold RE. MR enterography in the management of patients with Crohn disease. *Radiographics*. 2009 Oct;29(6):1827–46. doi: 10.1148/rg.296095510.
- Lu J, Zhou Z, Morelli JN, Yu H, Luo Y, Hu X, et al. A systematic review of technical parameters for MR of the small bowel in non-IBD conditions over the last ten years. *Sci Rep*. 2019 Oct 1;9(1):14100. doi: 10.1038/s41598-019-50501-9.