

MRI Prognostic Features in Rectal Cancer Neoadjuvant Trials: A Systematic Review of Reporting Gaps Across Two Decades

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Background

- Magnetic resonance imaging (MRI) is central to staging and treatment planning in rectal cancer.
- Prognostic MRI features such as extramural venous invasion (EMVI) and tumour deposits (TDs) are increasingly recognised as markers of systemic risk
- EMVI and TD reporting in randomised controlled trials (RCTs) remains unclear.
- This systematic review aimed to evaluate the reporting frequency, consistency, and integration of pre-treatment MRI prognostic variables in RCTs assessing neoadjuvant treatment for rectal cancer.

Methods

- Systematic search across MEDLINE, EMBASE, Web of Science, and CENTRAL
- Over 20 years (01st January 2005 to 18th November 2025)
- RCTs evaluating neoadjuvant strategies in adult patients with resectable rectal cancer
- Two reviewers independently extracted data on MRI variables, protocol details, and trial design. PRISMA guidelines were followed.

Outcomes of interest



The primary objective was to evaluate how pre-operative MRI features were reported across included RCTs. Specific outcomes included:



Pre-treatment MRI-derived prognostic variables reported at baseline (e.g., T stage, N stage, CRM involvement, EMVI, tumour deposits);



The role of MRI in trial design (e.g., use in eligibility, stratification, or response assessment);

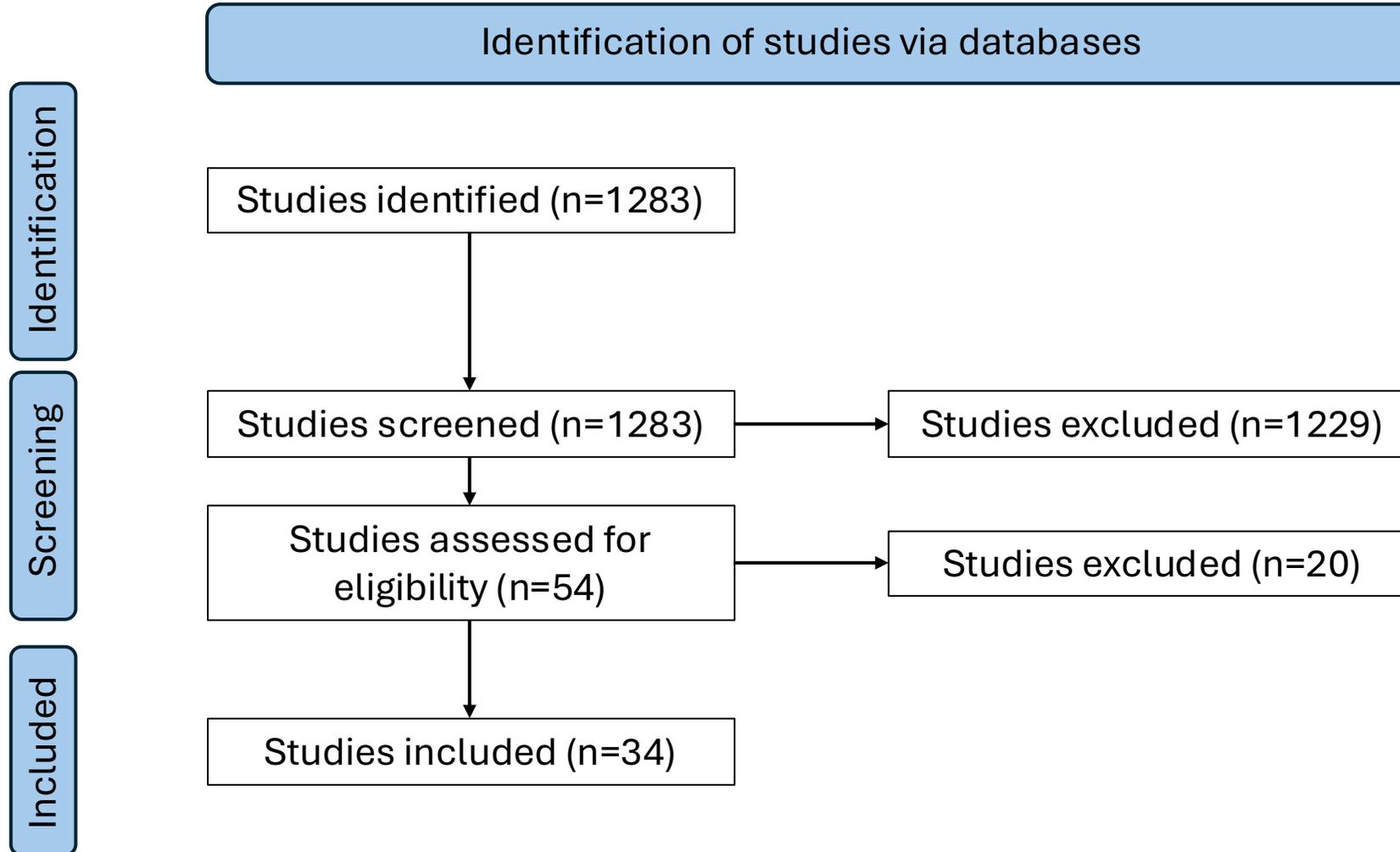


Definitions and consistency of key MRI variables across studies;



Technical parameters and standardization of MRI acquisition protocols.

Results



| Author | Year | Country | mrT | mrN | mrCRM | mrEMVI | mrTD | PSW | Tumour Height ^a | Other Imaging Modalities Reported | % with MRI Pelvis |
|-------------------------|------|---|-----|-----|-------|--------|------|-----|----------------------------|-----------------------------------|-------------------|
| Bahadoer et al. | 2021 | Netherlands, Sweden, Spain, Slovenia, Denmark, Norway, USA. | 1 | 1 | 1 | 1 | 0 | 1 | 0 | MRI Pelvis | 100 |
| Hofheinz et al. | 2024 | Germany | 1 | 1 | 1 | 0 | 0 | 0 | 0 | MRI Pelvis | 85.7 |
| Singh et al. | 2017 | India | 1 | 1 | 0 | 0 | 0 | 0 | 0 | MRI Pelvis | Not available |
| Garcia-Aguilar et al. | 2022 | USA | 1 | 1 | 0 | 0 | 0 | 0 | 0 | MRI Pelvis | 100 |
| Pesantez et al. | 2023 | Spain | 1 | 1 | 0 | 0 | 0 | 0 | 0 | MRI Pelvis | 100 |
| Bugano et al. | 2024 | Brazil | 1 | 1 | 1 | 0 | 0 | 0 | 0 | MRI Pelvis | 100 |
| Li et al. | 2024 | China | 1 | 1 | 1 | 0 | 0 | 0 | 1 | MRI Pelvis | 100 |
| Dewdney et al. | 2012 | UK, Spain, Australia | 1 | 1 | 1 | 1 | 0 | 0 | 1 | MRI Pelvis | 100 |
| Ngan et al. | 2012 | Australia, New Zealand | 1 | 1 | 0 | 0 | 0 | 0 | 1 | ERUS + MRI Pelvis | 30.9 |
| Ominelli et al. | 2022 | Brazil | 1 | 1 | 1 | 1 | 0 | 0 | 1 | MRI Pelvis | Not available |
| Fernandez-Martos et al. | 2015 | Spain | 1 | 1 | 1 | 0 | 0 | 0 | 1 | ERUS + MRI Pelvis | 100 |
| Rouanet et al. | 2022 | France | 1 | 1 | 1 | 0 | 0 | 0 | 0 | MRI Pelvis | Not available |
| Liu et al. | 2022 | China | 1 | 1 | 1 | 1 | 0 | 0 | 0 | MRI Pelvis | 100 |
| Fernandes-Martos et al. | 2010 | Spain | 1 | 1 | 0 | 0 | 0 | 0 | 0 | ERUS + MRI Pelvis | 100 |
| Lefevre et al. | 2019 | France | 1 | 1 | 1 | 0 | 0 | 0 | 0 | ERUS + MRI Pelvis | 87.9 |
| Glynn-Jones et al. | 2018 | UK | 1 | 1 | 1 | 1 | 0 | 0 | 0 | MRI Pelvis | 100 |
| Conroy et al. | 2024 | France | 1 | 1 | 1 | 0 | 0 | 1 | 1 | MRI Pelvis | 100 |
| Bini az et al. | 2024 | Iran | 1 | 1 | 0 | 0 | 0 | 0 | 0 | ERUS + MRI Pelvis | Not available |
| El Sahi et al. | 2023 | Egypt | 1 | 1 | 0 | 0 | 0 | 0 | 1 | MRI Pelvis | 100 |
| Serra-Aracil et al. | 2023 | Spain | 1 | 1 | 0 | 0 | 0 | 0 | 1 | ERUS + MRI Pelvis | 90.5 |
| He et al. | 2022 | China | 1 | 1 | 0 | 0 | 0 | 0 | 1 | MRI Pelvis | 95.4 |
| Rullier et al. | 2020 | France | 1 | 1 | 0 | 0 | 0 | 0 | 1 | MRI Pelvis | Not available |
| Wang et al. | 2018 | China | 1 | 1 | 0 | 0 | 0 | 0 | 1 | MRI Pelvis | Not available |
| Chen et al. | 2023 | China | 1 | 1 | 1 | 1 | 0 | 0 | 0 | MRI Pelvis | 100 |
| Collins et al. | 2018 | UK | 1 | 1 | 1 | 1 | 0 | 0 | 1 | MRI Pelvis | 100 |
| Shen et al. | 2023 | China | 1 | 1 | 1 | 1 | 0 | 0 | 1 | MRI Pelvis | 100 |
| Bach et al. | 2020 | UK | 1 | 1 | 0 | 0 | 0 | 0 | 1 | ERUS + MRI Pelvis | |
| Jin et al. | 2022 | China | 1 | 1 | 1 | 1 | 0 | 0 | 1 | ERUS + MRI Pelvis | 100 |
| Bujko et al. | 2020 | Poland | 1 | 0 | 0 | 0 | 0 | 0 | 1 | MRI Pelvis | 66 |
| Verheij et al. | 2023 | USA | 1 | 1 | 0 | 0 | 0 | 0 | 1 | MRI Pelvis | 100 |
| Schrag et al. | 2023 | USA | 1 | 1 | 0 | 0 | 0 | 0 | 1 | ERUS + MRI Pelvis | 84.3 |
| Sebag-Montefiore et al. | 2009 | UK, Canada, South Africa, New Zealand | 1 | 1 | 1 | 0 | 0 | 0 | 1 | ERUS + MRI Pelvis + Pelvic CT | 41 |
| Gerard et al. | 2012 | France | 1 | 1 | 1 | 0 | 0 | 0 | 1 | ERUS + MRI Pelvis | 52.1 |
| Mei et al. | 2022 | China | 1 | 1 | 1 | 1 | 0 | 1 | 1 | ERUS + MRI Pelvis | 100 |

Summary of results

- 34 studies (100%) reported MRI-based T staging
- 33 out of 34 studies (97%) reported MRI-based N staging
- 10 out of 34 studies (29%) reported mrEMVI
- No studies (0%) reported mrTDs
- 5 out of 34 studies specified MRI protocol acquisition parameters
- 10 studies incorporated EMVI or TDs into risk stratification frameworks.
- 4 trials did not mandate MRI for baseline staging.

Discussions

- Variability in reporting MRI prognostic features across RCTs evaluating neoadjuvant treatment strategies in rectal cancer.
- mrT and mrN stage most common
- mrEMVI rarely used
- mrTD not used in any RCTs
- Multiple studies have shown that mrEMVI and mrTD are independently associated with increased risk of systemic recurrence and worse survival outcomes in patients with locally advanced rectal cancer
- Prognostic value of mrEMVI / mrTDs exceeds that of radiologically positive lymph node, which currently the most used criterion for initiating neoadjuvant therapy

Discussions

- Lack of radiological standardization in reporting mrEMVI and mrTD
- Overreliance on mrN as the basis for treatment escalation may lead to overtreatment

Conclusion



Despite MRI's critical role in rectal cancer management, key prognostic features such as EMVI and TDs are underreported in RCTs.



This omission risks poor risk stratification, trial imbalance, and misinformed clinical guidance.



Future studies must implement consistent acquisition protocols, adopt structured radiology reporting, and routinely capture high-risk features such as EMVI and tumour deposits to enhance trial validity and optimise personalised treatment strategies.