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Incidental Findings and Their Significance in Rectal MRI: UK Experience

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Abstract:

Rectal MRI studies used to stage and guide surgical or nonsurgical management of rectal cancer may harbor incidental findings (IFs) of varying significance. St George's Hospital uses a four-sequence MRI protocol which does not employ diffusion-weighted imaging (DW-MRI).

Objectives: To determine the frequency and significance of incidental findings identified when using a rectal MRI protocol which does not employ DW-MRI.

Methods: Retrospective analysis of rectal MRI study reports for IFs and stratifying their significance. Medical records were reviewed to clarify IFs of interest.

Results: One hundred thirty-four studies met the inclusion criteria for the study (75 men, mean age 65). 51/134 (38%) of studies had IFs. Fifteen percent (n = 7/46) of baseline studies for a new cancer had significant IFs. The commonest IF was diverticular disease (n = 10); however, a bladder malignancy was also identified.

Conclusion: Clinically significant IFs exist in 12% of patients undergoing rectal MRI, and any type of IFs exist in 38% of patients undergoing rectal MRI studies. The rate of significant IFs is comparable with other authors both in rectal and prostate MRI but with fewer overall IFs, possibly due to the lack of DW-MRI sequences in our local protocol. Our study is the first to assess IFs using a rectal MRI protocol which does not employ DW-MRI, and the results should be considered by centers when planning their rectal MRI protocol.

Keywords: rectal cancer, magnetic resonance imaging, incidental findings

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INTRODUCTION

Approximately 43,000 new cases of colorectal cancer are diagnosed every year, and it is the fourth commonest cancer in the United Kingdom, accounting for 11% of all new cancer cases.[1] MRI of rectal cancer (rectal MRI) is used primarily for staging/restaging of rectal adenocarcinoma. It enables an assessment of whether the tumor has high risk features such as extramural spread,[2] tumor deposits,[3] extramural venous invasion,[4] involvement of the surgical plane (circumferential resection margin[5,6] or intersphincteric plane).[7] These features can guide whether the patient may benefit from preoperative down-staging of the tumor with neoadjuvant chemoradiotherapy.[8–10]

As with all imaging, incidental findings may be identified, which can be defined by the American College of Radiology as "an incidentally discovered mass or lesion, detected by CT, MRI, or other imaging modality performed for an unrelated reason"[11] or by the Royal College of Radiologists as "a finding that has potential health or reproductive importance, unknown to the participant, which is discovered unexpectedly in the course of conducting research, but is unrelated to the purpose and beyond the aims of the study" in the context of research.[12] These may be unknown or unimportant, or may be potentially significant and impact management and prognosis, such as synchronous tumors. Our hospital (St George's Hospital NHS Foundation Trust) is performing an increasing number of rectal MRI studies each year. For example, from 2019 to 2022 the number of rectal MRI studies performed at our hospital increased from 164 to 247. This may relate to the increase in the use of a "watch and wait" approach to rectal cancer, utilizing surveillance with imaging and endoscopy in selected patients with good response to neoadjuvant therapy.[13] With the increase in workload, there will be an increase in the number of incidental findings identified, leading to a cascade effect, with further investigation, management, procedures, and patient anxiety.[14]

A recent publication by Tang et al[15] described the frequency of incidental findings in rectal MRI, demonstrating 55% of studies with an incidental finding, 9% of them were regarded as clinically significant. This is similar to the prevalence of incidental findings in multiparametric prostate MRI. In studies by Sherrer et al[16] and Cutaia et al,[17] 40–53% of studies had incidental findings of any type, and 13%–16% had incidental findings deemed potentially clinically significant. This compares with 38% of studies containing incidental findings in whole-body MRI performed for myeloma.[18]

Tang et al[15] study looks at rectal MRI performed with DW-MRI sequences; in our practice, we do not use DW-MRI sequences according to the MERCURY validated parameters.[19]

AIMS

We aimed to determine the frequency, significance, and stability of incidental findings using a rectal MRI protocol which does not employ DW-MRI.

MATERIALS AND METHODS

Population

A database of all the studies labelled "MRI Rectum" and "MRI Rectum with contrast" during the year of 2022 was acquired from the hospital's RIS (Radiology Information System) software. Although contrast is not routinely used, studies labelled "MRI Rectum with contrast" were included for completeness. Data on

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the patient demographics were automatically acquired to include date of birth and gender.

Studies reported as nondiagnostic and mislabeled nonrectal MRI (e.g., perianal fistula protocol studies) were excluded. The NHS National Data opt-out database was cross-checked, and patients registered to this were removed from the data set.

Two hundred forty-seven studies labelled "MRI Rectum" were performed from January 1, 2022, to December 31, 2022. None were performed with contrast or were labelled "MRI Rectum with contrast." Forty-nine more were excluded due to exclusion criteria as detailed in Figure 1 below. If patients had multiple studies during the set timeframe, the first study was named the index study for the purposes of determining the per patient frequency and significance of incidental findings. All subsequent studies were assessed for longitudinal stability over repeat studies within the 1-year time frame.

MRI Technique

Rectal MRI scans were performed on either GE Signa HDX 1.5T MRI scanner or Siemens Sola 1.5T MRI scanner as per local protocol using established imaging parameters validated by the MERCURY Group.[19] Four sequences are acquired as part of our Hospital's rectal MRI protocol: 3-plane small field of view sequences including axial/oblique angled to the site of tumor of interest and a large field of view axial T2 sequence of the pelvis. Diffusion-weighted sequences and postcontrast imaging are not routinely used in our department.

Classification of Incidental Findings

Each study report was assessed for the presence of incidental findings and the details of the findings recorded. These were then assigned a significance score graded using the CT-Colonography Reporting and Data System extracolonic findings E-score (C-RADS E-score classification),[20,21] providing a defined grading system for this study. This is summarized in Table 1.

For this study, E3 and above were deemed significant. If a patient had multiple incidental findings, these were all recorded but graded according to the most significant. We did not classify only malignant findings as significant, whereas took into account if the finding was new, had the potential to cause symptoms, or would need further workup. Uncertainties in grading were highlighted initially and clarified by opinion from a gastrointestinal radiologist with over 5 years' experience in colorectal imaging.

Data collectors enlisted included radiology registrars graded ST2-5, general surgical registrars and an SHO level doctor. The reports were analyzed retrospectively. As the data collectors did not solely include senior subspecialty radiology registrars, the images were not reviewed as part of the data collection process. MRI rectal studies were all initially reported by at least 1 consultant radiologist with a special interest in colorectal radiology.

Ethical Review, Confidentiality Compliance, and Statistical Analysis

Institutional review board approval deemed ethics review or patient consent to not be required for this study. The database

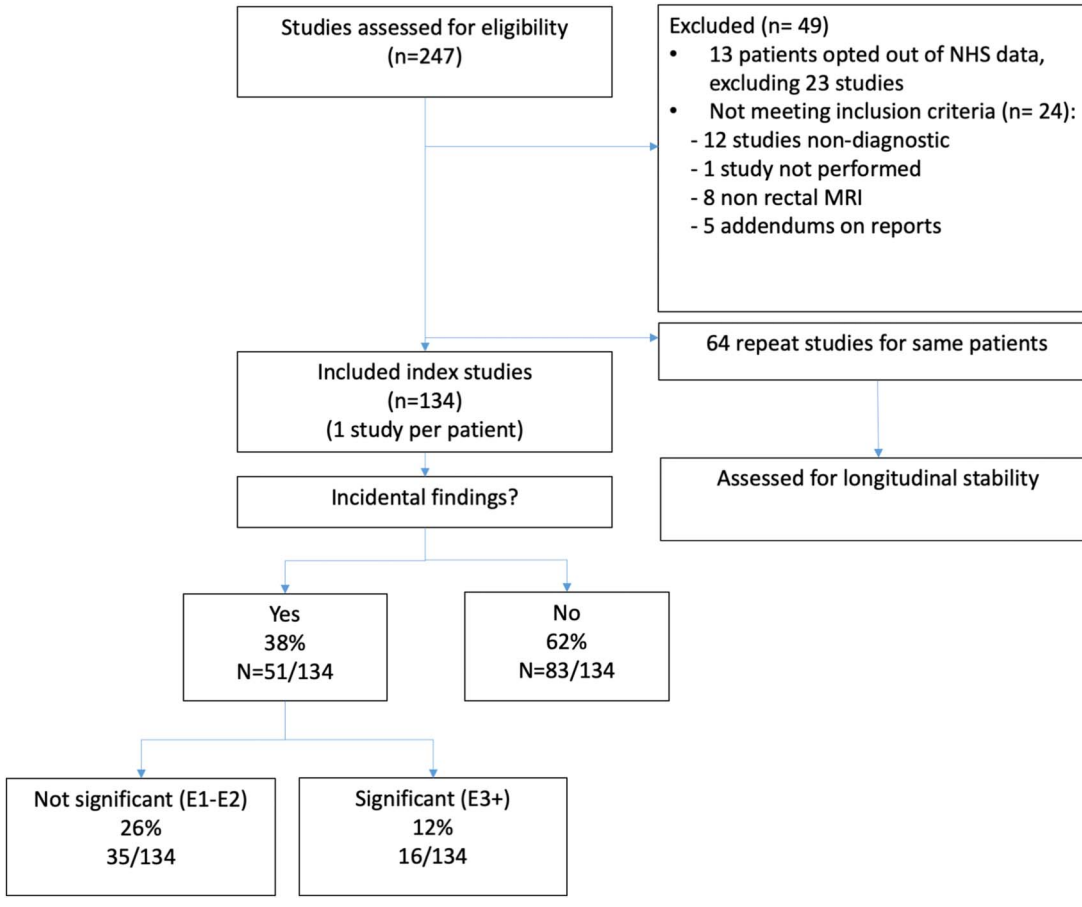

FIGURE 1. Consort flowchart—inclusion criteria and primary results

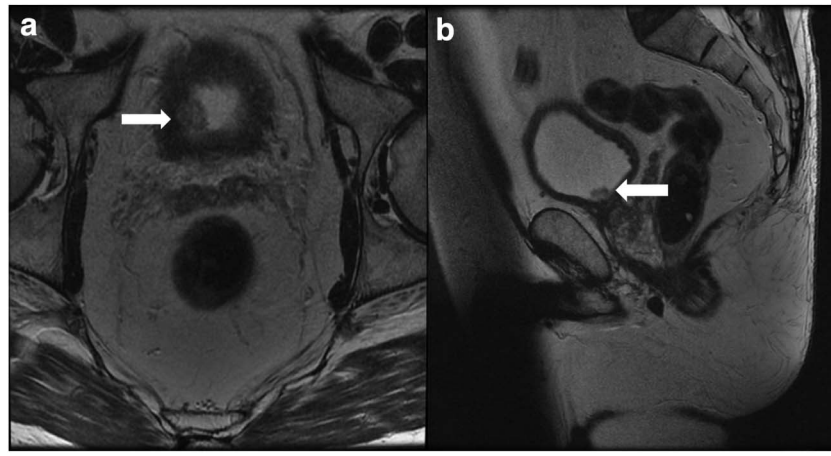

FIGURE 2. Incidental bladder tumor. Seventy-year-old man underwent an MRI for follow-up of excised incidental NET found on colonoscopy. Axial (left) and sagittal (right) T2 small (field-of-view) FOV images demonstrating a small, irregular bladder mass (arrows). This was histologically proven malignant and subsequently resected.

was stored securely using NHS shared drive and only shared amongst the data collectors and project supervisors. Automated formulae were used to ensure correct calculations of the results, with the totals cross-checked to ensure no discrepancies. The Fisher exact test was used to check for statistical significance using the MedCalc online software, by MedCalc Software Ltd, version 23.1.7.[22] A *P*-value of <0.05 was considered significant.

RESULTS

Demographics

The final data set included 134 studies in 134 patients after exclusion criteria were applied, and repeat studies were removed from the final data set. 75/134 (56%) were male. The age range was 30–89 years. The mean age was 65 years. 72/134 (54%) were ≥65 years old.

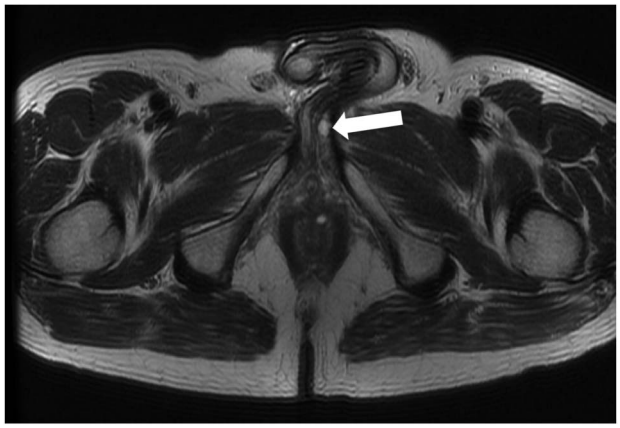

FIGURE 3. Incidental penile lesion. Axial T2 large FOV image demonstrating a presumed cystic lesion in the left corpus cavernosum of the penis (arrow).

Frequency of Incidental Findings

51/134 (38%) of studies had incidental findings. Of these, 16/134 (12%) of studies had significant incidental findings (graded E3 or above). 8/51 (16%) of studies had 2 incidental findings, taking the total number of incidental findings to 59.

There was no statistically significant difference in the presence of significant incidental findings in patients 65 years or older versus younger than 65 years using the Fisher exact test ($P = 0.216$).

Thirty-four percent of studies (n = 46) were baseline scans for a new cancer. Of these, 26% (n = 12/46) had incidental findings of any grade, and 15% (n = 7/46) of baseline studies had significant incidental findings (E3 or above).

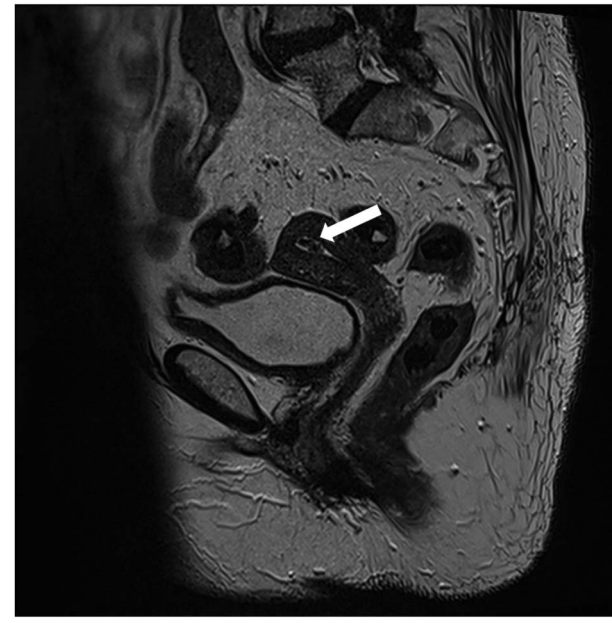

FIGURE 4. Endometrial polyp. Sagittal T2 small FOV image of a 78-year-old womanfor further assessment for an excised rectal polyp, showing an endometrial polyp (arrow), which was subsequently confirmed on transvaginal ultrasound.

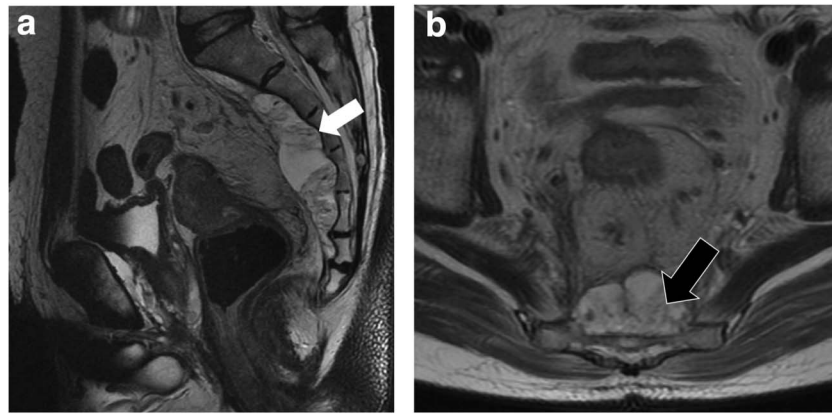

FIGURE 5. Presacral plexiform neurofibroma. Sagittal (left) and axial (right) T2 small FOV sequences showing a presacral lesion measuring up to 9.5 cm in craniocaudal dimension from S1 to the coccyx. It is predominantly T2 hyperintense with linear internal low signal (black arrow). It is symmetrical and tracks along presacral nerves but does not extend into the neural foramina. There is scalloping of the anterior sacrum suggesting slow growth (arrow). This lesion has characteristic features of a plexiform neurofibroma.[23]

Types of Incidental Findings Grouped by System

Incidental findings related to multiple systems, summarized in Table 2. Some patients had multiple incidental findings, which have been included separately in this table, and the total therefore exceeds 51. The most reported incidental finding was diverticular disease (n = 10), followed by hernias (n = 6), predominantly inguinal. Other gastrointestinal incidental findings included a new perianal fistula and a known retrorectal hamartoma. Genitourinary findings included a bladder lesion (Fig. 2) which was subsequently proven malignant and resected, a penile abnormality (Fig. 3), prostatic abnormalities, and uterine findings such as fibroids and an endometrial polyp (Fig. 4). Musculoskeletal pathologies included degenerative disc disease in the lumbosacral spine (in 1 case known and in another case new), abnormal bone marrow signal, and a presacral plexiform neurofibroma (Fig. 5).[23] A suspected deep vein thrombosis was also reported on a study.

Further imaging was suggested in the report body or conclusion for 7 patients. The suggested further imaging was performed in 5 of the 7 patients. For 2 patients, further imaging was recommended but not performed; 1 patient had an MRI prostate advised and requested to clarify the abnormal signal seen on the rectal MRI; however, this was cancelled due to "patient request." Another study revealed an indeterminate penile lesion which, although had been stable since prior imaging, remained incompletely characterized; however, this was not imaged further due to its stability.

Incidental Findings Over Time

Forty-six patients had multiple studies during the one-year timeframe, mainly for post-treatment follow-up. The average number of studies each of these patients had was 2.4, the median was 2, and the range was 2–5. Thirty-one patients had 2 studies during the study period, 12 patients had 3 studies, 2 patients had 4 studies, and 1 patient had 5 studies. The average time interval between studies was 3.6 months. When the multiple studies were assessed, the incidental findings stayed consistent over the 1-year time period. None of the patients with multiple studies during the time frame had clinically significant findings (E3–E5).

TABLE 1. The C-RADS E-Score Classification 2021

Grade	Definition
E1	Normal, anatomic or post-surgical variant
E2	Incidental, unimportant/already known
E3	New incompletely characterised finding, (further investigation according to local protocol)
E4	Potentially important new finding, requires further action
E5	Significant new finding identified

DISCUSSION

Our study has shown that incidental findings in rectal MRI are common, occurring in 38% of cases. Twelve percent of studies had significant incidental findings. This highlights the importance of reviewing imaging for incidental findings and considering the most appropriate and economical method of further investigation.

There is variability in the reported prevalence of incidental findings. Tang et al[15] report the only publication of incidental findings in rectal MRI and found 55% of rectal MRI scans identified an incidental finding, 9% of which were significant. We found fewer overall incidental findings but with similar proportions of significant findings. Our results were comparable with those found in prostate MRI; Cutaia et al[16] reported 40% prevalence of incidental findings with 13% significant,[17] and Sherrer et al reported 53% prevalence of incidental findings with 16% significant. It is unclear whether this variability is related to imaging technique. However, Tang et al performed rectal MRI with DW-MRI, whereas we do not use DW-MRI sequences. This reflects international variability in the sequences employed for rectal MRI, much of the United Kingdom using those validated by the MERCURY Study Group with some also employing DW-MRI as per the European guidelines.[5,24,25]

It was thus important to determine whether the incidental findings in the United Kingdom are comparable with the prior paper from Tang et al.[15]

With DW-MRI, as used in the study by Tang et al,[15] there is the potential for increased rates of potential abnormality identified which could be characterized using the other sequences, such as abnormalities in the prostate which can then be correlated to the T2 small field-of-view. The use of DW-MRI may also include findings that are difficult to characterize further, such as increased bone marrow signal of indeterminate significance, which can relate to a variety of nonmalignant pathologies, such as hemangiomas, degenerative disc disease, and avascular necrosis, as demonstrated by a study including whole body diffusion-weighted MRI (WB DW-MRI).[18] This uncertainty whilst waiting for further tests may result

TABLE 2. Type of Incidental Finding Grouped by System

System	Type	Significance	n	%
		E1-2 Not significant E3-5 Significant		
Gastrointestinal				
	Diverticular disease	Not significant	10	16.9
	Hernias	Not significant	6	10.2
	Other (known retrorectal hamartoma)	Not significant	1	1.7
	Abscess, perforation or fistula	Significant	3	5.1
	Duplication cyst	Significant	1	1.7
	Peritoneal inclusion cyst	Significant	1	1.7
	Perianal subcutaneous lesion	Significant	1	1.7
	Total gastrointestinal		23	39.0
Genitourinary				
	Hydroceles	Not significant	2	3
	Prostate enlargement	Not significant	4	7
	Uterine fibroids	Not significant	3	5
	Adnexal abnormalities	Not significant	3	5
	Nabothian cysts	Not significant	4	7
	Pelvic kidney	Not significant	1	2
	Abnormal prostate gland signal	Significant	1	2
	Penile lesion	Significant	1	2
	Bladder lesion	Significant	1	2
	Endometrial polyp	Significant	1	2
	Bartholin gland cyst	Significant	1	2
	Total genitourinary		22	37.3
Musculoskeletal				
	Abnormal bone signal	Not significant	2	3.4
	Tarlov cyst and dural ectasia	Not significant	5	8.5
	Degenerative disc disease (known)	Not significant	1	1.7
	Old fracture	Not significant	1	1.7
	Presacral lesions	Significant	2	3.4
	Degenerative disc disease (new)	Significant	1	1.7
	Total musculoskeletal		12	20
Other				
	Phlebolith	Not significant	1	1.7
	Possible DVT	Significant	1	1.7
	Total other		2	3.4
	Total overall		59	100

in added anxiety for the patient and additional costs incurred, although equally may pick up clinically important pathologies which need further management. The variability between our results and those of Tang et al[15] may also relate to the generous saturation band used in our protocol compared with prostate MRI, or the retrospective analysis of reports, rather than images in our study methodology, which may cause an underestimation of the true number of incidental findings. Our study utilized a validated methodology for the classification of incidental findings as per Zalis et al.[20] This system is routinely employed by gastrointestinal radiologists as part of CT colonography reporting and the NHS Bowel Cancer Screening Programme[26] and therefore potentially less prone to inter observer variability than the three-point scale used by Tang et al.[15]

For all patients who had multiple studies, the incidental findings were stable throughout the 1-year timeframe, reassuring for benignity. All patients with clinically significant E3–5 findings only had 1 study during the one-year timeframe, including the patients with the bladder tumor and endometrial polyp. This is because if a finding was already known it would have been already investigated and therefore deemed E2. Patients with new incidental findings are therefore more likely to be significant and require vigilance and further workup. Tang et al[15] excluded patients having follow-up/post-treatment studies, whereas our data have included these in the data set, which is more representative of day-to-day reporting workload. Patients with well-visualized but indeterminate incidental findings on rectal MRI may not need specific further imaging if they will be undergoing follow-up MRI where stability could be assessed. For example, on average patients in our cohort undergoing follow-up had repeat MRI studies every 3.6 months, which may negate the need to characterize findings with low suspicion of significance such as equivocal bone marrow heterogeneity. This would not apply to any overtly concerning or malignant finding, such as the bladder tumor in our cohort, which needs swift characterization.

If further imaging or investigation is recommended due to a new incidental finding, we are reliant on systems to ensure results are acted on. This can be in the form of a local fail-safe alerting system. This requirement is evidenced by the Royal College of Radiologists (RCR) who state "Standard for the communication of radiological reports and fail-safe alert notification" document, which states "All radiological reports should be produced, read and acted upon in a timely fashion, best to serve the patients' needs" and "All reports should be read and acted upon by the referrer, their team and/or relevant clinicians."[27,28] This is especially important if a synchronous tumor in a nontarget organ is identified, to ensure treatment of primary pathology is not delayed unnecessarily.

Incidental findings present a significant workload for radiology departments and health care systems internationally, our data support this irrespective of international variability in imaging technique. Conversely, the over-use of imaging can generate excess workload and a balance must be struck to mitigate this risk. The need to report incidental findings when clinically insignificant is controversial, as patient access to records is increasing and reporting these may cause unnecessary anxiety. This can be a subjective and judgement may differ between radiologists and on a case-by-case basis.

Our study was limited by the loss of some studies from the analysis secondary to the NHS opt-out database but this was minimal and would not affect the overall results as they are comparable with the published literature. In addition, as described, images were not reviewed as part of the data collection, only reports; therefore, this may underestimate the true prevalence of incidental findings. There may also be some variability between data collectors in the interpretation of the C-RADS scale to assign the level of significance; however, consultant arbitration and the sample size would have helped mitigate this effect.

CONCLUSION

Clinically significant incidental findings exist in 12% of patients undergoing rectal MRI and any type of incidental findings exist in 38% of patients undergoing MRI studies. The rate of significant incidental findings is comparable to other authors both in rectal and prostate MRI but with fewer overall incidental findings, possibly due to the lack of diffusion-weighted MRI sequences in our local protocol. The sequences used for rectal MRI are variable; our practice is to follow the high resolution T2 sequences validated by the MERCURY study. Reassuringly our spectrum of incidental findings was not different to Tang et al suggesting irrespective of the sequences used the spectrum of findings is similar. These factors should be considered by centers when planning their rectal MRI protocol and by radiologists when reporting these studies.

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