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ORIGINAL ARTICLE

Evidence-based gynaecological practice: clinical review 3. The use of imaging for pre-operative planning in deep infiltrating endometriosis involving the rectum

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Abstract In this third review of the series of evidence-based practice reviews of clinical practice, we examine the evidence for the use of imaging techniques in the pre-planning for surgery for deep infiltrating endometriosis, particularly where there is recto-sigmoid disease. As in previous evidence-based practice reviews, we set a clinical scenario of a patient with suspected deep infiltrating endometriosis affecting her left utero-asacral ligament and with a suspicion of recto-sigmoid disease and ask which diagnostic tests would be the most accurate for diagnosis and pre-operative planning.

Keywords Recto-sigmoid · Endometriosis · Imaging · Rectal endometriosis · Deep infiltrating endometriosis · Disease staging · Sonography · MRI

Our patient

Miss A is a 32-year-old accountant with a history of severe dysmenorrhoea, deep dyspareunia and some dyschezia. Digital examination suggests she has a small nodule of endometriosis between her cervix and her rectum involving the left utero-sacral ligament. Her clinician is concerned about possible rectal involvement and the potential need for bowel surgery. She has been advised that it would be appropriate for her to undergo a magnetic resonance imaging scan, transvaginal and transrectal ultrasound examinations to look at this area in more detail. Although willing to undergo whatever examinations are completely necessary, Miss A is claustrophobic and would not wish to undergo an enema or transrectal examination unless they were going to have a real advantage to the planning of her surgery. What would our advice be?

The question we want to ask of the literature is: in women with typical clinical signs and symptoms of deep endometriosis, what is the accuracy of magnetic resonance imaging (MRI), transvaginal sonography (TVS) and transrectal sonography (TRS) for the detection of and staging of deep infiltrating endometriosis in the rectum and recto-sigmoid colon, when compared to laparoscopy and histology?

Declaration of interest The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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Introduction

Deep-infiltrating endometriosis is a term used to describe endometriotic lesions that penetrate for more than 5 mm under the peritoneal surface. It infiltrates into vital structures such as the bowel, bladder and ureters. For the purpose of answering our clinical question, we are concerned with endometriosis that infiltrates into the rectal and recto-sigmoid area where there is involvement of the muscularis of the bowel wall. Our focus on this is simply because the surgical treatment of endometriosis in these areas will require some form of bowel excision, and therefore appropriate patient counselling and pre-operative preparation.

Surgery for deep infiltrating endometriosis

It is now reasonably well established that deep infiltrating endometriosis in the posterior cul de sac is best treated

surgically [1, 2] and will usually involve the dissection of the pelvic sidewall, utero-sacral ligaments and the recto-vaginal space. This dissection is within the competence of the appropriately trained gynaecologist but when the rectum or recto-sigmoid colon is affected, appropriate involvement of general surgeons will be necessary. Although the presences of endometriosis can only be determined accurately by histology, pre-operative investigations should ideally be able to accurately confirm, or more importantly, exclude rectal or recto-sigmoid involvement so that the woman can receive proper counselling on the surgery she will undergo, and ensure the necessary surgical team is available and prepared. In this review, we look at the accuracy of pre-operative imaging in both confirming and excluding rectal and recto-sigmoid involvement by deep infiltrating endometriosis.

Accuracy of diagnostic tests

When considering the accuracy of diagnostic tests it is important to understand not only the methodology of diagnostic test studies but the outcomes such as sensitivity, specificity, positive and negative predictive values and positive and negative likelihood ratios (Table 1). With these measures, we can assess whether a test is clinically useful or not and then we need to decide whether the test is then both cost-effective and acceptable to patients.

Sensitivity is the proportion of people with the disease that are correctly identified with a positive test result. Specificity is the proportion of people without the disease who are correctly identified with a negative test result. A test that has a sensitivity of 98% and a specificity of 50% is good at correctly identifying diseased patients but not so good at correctly identifying true-negative patients.

Table 1 2×2 Table for diagnostic test studies

		Target disorder	
		Present	Absent
Diagnostic test result	Positive	True positive a	False positive b
	Negative	False negative c	True negative d

Sensitivity a/(a+c)

Specificity d/(b+d)

Positive predictive value a/(a+b)

Negative predictive value d/(c+d)

Prevalence (pre-test probability) (a+c)/(a+b+c+d)

Positive likelihood ratio (LR+) sensitivity/(1-specificity)

Negative likelihood ratio (LR−) (1–sensitivity)/specificity

However, calculations of sensitivity and specificity can only tell us how good the test is in general and it is difficult to relate these measures to an individual patient as there is no way of predicting whether a positive test result in a specific patient is a true-positive or false-positive result and whether a negative test result is a true-negative or false-negative result [3]. For this reason, positive and negative predictive values were developed. The positive predictive value is the proportion of patients with a positive test result that is truly positive; the negative predictive value is the proportion of patients with a negative test that is truly negative. These measures, however, are dependent on the prevalence of disease within the study population and are therefore not necessarily generalisable to every clinical population [3].

In order to find out what the chances are of a patient with a positive or negative test result having or not having the disease, the likelihood ratios (LRs) need to be calculated. The LR incorporates both the sensitivity and specificity of the test and provides an estimate of how much a positive or negative test result changes the chances of having or not having the disease. So a positive LR tells you how much more likely patients are to have the disease when the test is positive. The negative LR tells you how much less likely patients are to have the disease when the test is negative.

In general terms, a positive likelihood ratio of more than 10 indicates that a test is good at confirming disease if the test is positive and a negative likelihood ratio of less than 0.1 indicates that the test is good at excluding disease when the test is negative.

A particular benefit with a LR is that it can be combined with the prevalence of the disease (pre-test probability) to give you the post-test probability for an individual patient. Figure 1 summarises the interpretation of LRs in relation to the usefulness of the test to confirm or exclude disease and the approximate change in pre-test probability of disease [4]. The easiest way to calculate the post-test probability is to use a likelihood nomogram (Fig. 2). From Fig. 2, you will see that the disease prevalence (pre-test probability) is 50%. So for patients who have not had any tests, but present with the typical signs of a given disease that has a 50% prevalence, they have a 50% chance of having the disease. The positive LR for our test is 35. If you follow the line, you will see that this results in a post-test probability of 95%. This means that following a positive test result, our patient, has a 95% chance of having the disease. Her chances have increased from 50% to 95%. Similarly, if the negative likelihood for our test is 0.1 and our patient had a negative test result, her chances of not having the disease have gone from 50% (the prevalence) to just 9%.

You can access an interactive nomogram and 2×2 calculator that will calculate sensitivity, specificity and likelihood ratios with their 95% confidence intervals from diagnostic test study

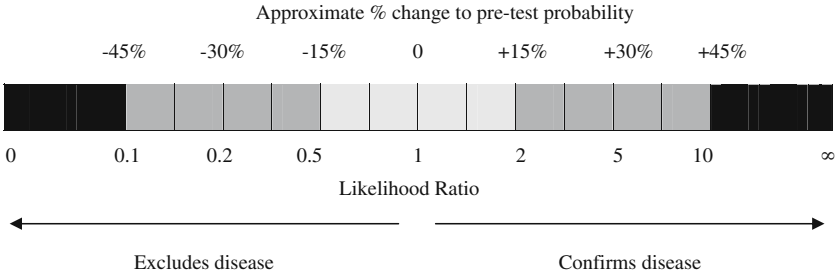

Fig. 1 Interpretation of likelihood ratios [3, 4]

results online through the Centre for Evidence Based Medicine www.cebm.net. Without the nomogram, the post-test probability of disease can be calculated in the following way:

$$\begin{aligned}&\text{Pre-test odds} = \text{pre-test probability}/(1-\text{pre-test probability})\\&\text{Post-test odds} = \text{pre-test odds}*\text{LR}\\&\text{Post-test probability} = \text{pre-test odds}/(\text{post-test odds}+1)\end{aligned} \quad (1)$$

Critical appraisal of diagnostic test studies

When critically appraising diagnostic studies, there are a number of criteria that determine whether or not there is a risk of bias affecting the results of the study [5, 6]. With a significant risk of bias, it is unlikely that the results of the study are accurate. The following points should be considered when reading studies of diagnostic test accuracy that relate to our clinical scenario:

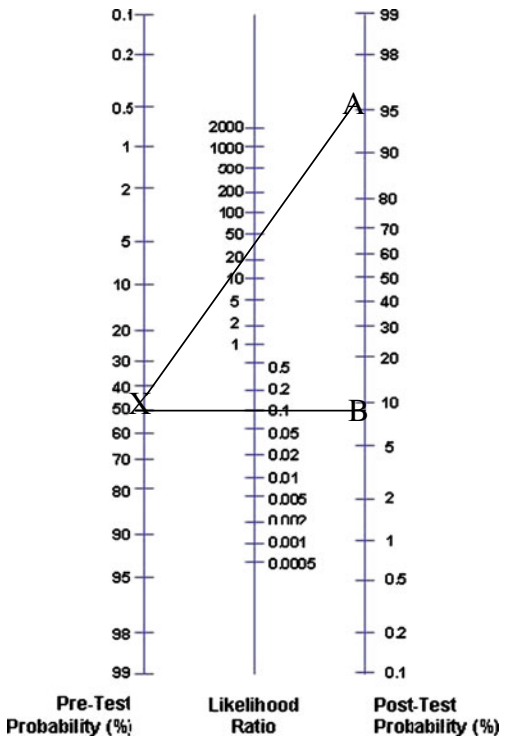

Fig. 2 Likelihood nomogram (adapted from Centre for Evidence Based Medicine www.cebm.net). For example, if our test has a LR+ of 35 and LR− of 0.1 and our patient's pre-test probability of 50% (*X*), a positive test will lead to a post-test probability (*A*) of approximately 95.5% and a negative test a post-test probability (*B*) of approximately 9%

- Were the diagnostic tests (MRI, TVS, TRS) conducted on all women with clinical signs and symptoms of deep infiltrating endometriosis or were patients randomly selected to be in the study? It is important that recruitment of people to a diagnostic study is either done consecutively or randomly so that there is no bias in the sample. In our clinical scenario, if patients are recruited only on the basis of a high suspicion of deep infiltrating disease, the tests (MRI, TVS, TRS) are not being rigorously examined. Moreover, the number of negative test results (both true and false negative) will be very low, leading to wide confidence intervals and imprecise results which are difficult to interpret.
- Did all participants receive both the tests being studied (MRI, TVS, TRS) and the gold standard test which the study tests are being compared to? For our clinical scenario, we would want the gold standard test to be surgical diagnosis with histology.
- If, as often happens when the gold standard test is surgical, a significant proportion of patients do not have a laparoscopy to confirm the presence or absence of endometriosis, the true negatives in the MRI, TVS and TRS will be overestimated and the false negatives will be underestimated.
- Were the investigators who performed the study test blinded to the clinical information? In our clinical scenario, if the investigator became aware that a patient had all the typical signs of deep endometriosis, s/he might be more vigilant in looking for evidence of disease when carrying out the MRI/TVS/TRS.
- Was there independent blind comparison between the study test results and the gold standard? In our clinical scenario, if the surgeon was aware of the results of the MRI/TVS/TRS, s/he might be more or less vigilant in looking for evidence of the disease.
- Was the sample size sufficiently large enough to produce precise estimates of the sensitivity, specificity and LRs? Diagnostic test studies require sample size calculations, generally based on the expected sensitivity and specificity. Unfortunately, few studies are based on

a sample size calculation, resulting in small, underpowered studies, with wide confidence intervals.

- Are the results of the study applicable to my patients? It is important to consider whether similar results would be achieved if applied to the patients in your hospital. In our clinical scenario, we would want to look at the both the test equipment being used in the research and the experience of the person carrying out the MRI/TVS/TRS. If the research study used imaging equipment that was not available in your own hospital, you may expect to get less reliable results in your own patients. On the whole, published studies draw on the work of clinicians with a specialist interest in the diagnostic test, and therefore, it may be that the person conducting the MRI/TVS/TRS is highly skilled in performing these tests.

This would mean that when performed in your own hospital, these tests may not perform as well as they did in the research study. Moreover, clinicians with an interest in the use of ultrasound for the diagnosis of endometriosis are more likely to identify disease than those without experience in the use of ultrasound for this condition; gynaecologists specialising in laparoscopic surgery for deep infiltrating disease are more likely to identify disease than general gynaecologists and those surgeons are also more likely to identify disease during digital examination. The generalisability of the results of diagnostic test studies, therefore, will very much depend on whether the environment in which the patient is being treated is similar in terms of clinical experience with the disease to that in which the study was conducted.

What question do you want to ask of the literature?

It is likely that this lady has deep infiltrating endometriosis and in order for her surgery to be appropriately planned with respect to any rectal or recto-sigmoid involvement, it would be useful to have some further information regarding the location of any endometriotic nodules that are present. The question we would want to ask of the literature is:

> In women with typical clinical signs and symptoms of deep endometriosis, what is the accuracy of MRI, TVS and TRS for the detection of and staging of deep infiltrating endometriosis in the rectum and recto-sigmoid colon, when compared to laparoscopy and histology?

In diagnostic test studies, the comparison, or reference, test would be that which is considered to be the gold standard. For the diagnosis of deep infiltrating endometriosis, the current gold standard would be the definitive surgical laparoscopy when the full extent of the disease will have been dissected out and endometriosis confirmed by histology.

Diagnostic laparoscopy relies on visual inspection and palpation and may under-estimate the extent of the disease. Consequently, any estimate of accuracy will depend not only on the skill of the clinician conducting the ultrasound examination or interpreting the MRI or ultrasound images, but also on the skill and experience of the clinician undertaking the laparoscopy.

Developing the search strategy and results from the search strategy

In reviewing the literature, it is important to look only at the recent literature as both the quality of images and expertise have improved dramatically over the last 6 or 7 years. For this reason, we have searched the literature from 2004 onwards bearing in mind the time lapse between the start of a study and its publication, this strategy would identify studies conducted from 2002.

A detailed review on sources of literature and on developing search strategies has been described in our first two papers in this clinical review series [7, 8]. The first type of paper we would search for would be for systematic reviews of the diagnostic accuracy of MRI, TVS or TRS for the diagnosis of endometriosis. The Cochrane Library now include systematic reviews with meta-analysis of diagnostic test accuracy and therefore we searched the Cochrane Library using the term "Endometrio*" and the MeSH term 'Endometriosis'. There were no completed systematic reviews of the diagnostic accuracy of MRI or ultrasound in the detection of endometriosis.

We then searched Medline for relevant systematic reviews 2004–2009 using the following search terms: (Endometriosis (MeSH) and (Exp Ultrasonography (MeSH)) or Exp Endosonography (MeSH) or Exp Magnetic Resonance Imaging (MeSH) or Exp Vagina/ultrasonography or Exp Rectum/ultrasonography or Exp Anal Canal/ultrasonography or Endosonograph* or Ultrasound or Ultrasonography) or Endometriosis/ultrasonography, radionuclide imaging, radiography. We used a clinical query to refine the search to literature reviews. The clinical queries are search filters and are set up to be highly sensitive, highly specific or the best balance of the two. We used the clinical query 'Reviews–Best Balance' for our search. The search produced 85 results none of which were useful in answering our question. The only review containing data on diagnostic accuracy of imaging for endometriosis that specifically reviewed bowel involvement [9] was not a systematic literature review, did not present LRs for the

tests and the included studies for this section of the review were published between 1991 and 2003.

A search of Embase using the following terms: (Exp Endometriosis and (Exp Transrectal Ultrasonography or Exp Transvaginal echography or Exp Echography or Exp Nuclear Magnetic Resonance Imaging or Ultrasound or Ultrasonography or Sonography or Endosonography)) and (Meta-analysis or Systematic Literature Reviews or Review) limited to 2004–2009 produced seven results, none of which were useful in answering our clinical question.

As the answer to our question could not be found from a systematic review of the diagnostic test accuracy literature, we searched Medline and Embase using the same search terms for primary studies. In Medline, the search was limited to 2004–2009 and we used the clinical query 'Diagnosis–Best Balance' to identify studies of diagnostic accuracy. In Embase, the search was combined with the following terms: (Sensitivity or Specificity or Diagnostic Accuracy).

Description of selected papers

The search of Medline produced 80 hits and the search of Embase produced 494 hits. After an initial screen of the titles and abstracts of the hits identified by the search, 29 papers were considered to be potentially useful and, of those, nine reported on the accuracy of imaging for rectal or recto-sigmoid involvement in deep infiltrating endometriosis [10–18], were deemed to be of sufficiently high methodological quality (as defined above) and provided data that could be used to construct 2×2 tables to calculate sensitivity, specificity, LR+ and LR− with 95% confidence intervals or reported these outcomes with confidence intervals within the paper. One further paper was identified from a publication alert after completion of the search [19]. Four studies reported the diagnostic accuracy of MRI [10, 12, 13, 19]; five studies reported the diagnostic accuracy of TRS [11, 13, 14, 18, 19] and seven studies reported on the diagnostic accuracy of TVS [10, 11, 15–19]. All of the papers investigated the accuracy of TVS, TRS or MRI for detecting rectal and/or recto-sigmoid endometriosis, although many of the papers used these two terms interchangeably. Seven of the papers reported data specifically for recto-sigmoid disease and six of the papers reported data specifically for rectal disease. One paper reported data for 'intestinal endometriosis'.

The pre-test probability (prevalence) of rectal or recto-sigmoid involvement was between 24% and 83% with most studies being between 40% and 60%. All of the studies compared the results of imaging to a surgical diagnosis with histological confirmation of deep infiltrating endometriosis. All but two (Chapron, Bazot 2009) of the studies were prospective in design and most used consecutive recruitment of patients and all studies were conducted in specialist centres for pelvic pain with experience in imaging in gynaecology. The studies by Bazot [11] and Chapron [13] were conducted using women referred for treatment of known deep infiltrating endometriosis, Delpy [14], Menada [17] and Piketty [18] included women with clinically suspected deep infiltrating endometriosis and Abrao [10], Chamie [12], Guerriero [15], Hudelist [16], and Bazot (2009) [19] included all women with clinically suspected endometriosis. Table 2 is a summary of the relevant studies identified from the search strategy.

The level of blinding in studies was variable but in the majority of studies, clinicians interpreting the results of the imaging examinations were aware of a potential diagnosis of endometriosis but were blinded to the results of physical examination and any other imaging used. The exception to this was in the study by Hudelist where the combination of per-vaginal (PV) examination and TVS was being investigated. The same examiner conducted the PV examination and TVS ultrasound which is possibly the study that used methodology closest to usual clinical practice.

We calculated the pre-test probability (prevalence) of rectal or recto-sigmoid deep infiltrating endometriosis, sensitivity, specificity, positive and negative likelihood ratios and the post-test probability for each study population based on a positive and negative test with 95% confidence intervals from data given in each paper (Table 2).

Generally, the very low numbers of false-positive and false-negative results meant that the confidence intervals were wide for the estimates of the LRs.

Transvaginal ultrasound

TVS techniques varied between studies but the majority used transvaginal probes operating at 5-9 MHz. Most of the studies used TVS alone however, Hudelist et al. [16] combined TVS with PV examination and Menada et al. [17] combined water contrast in the rectum with TVS. Positive LRs for TVS indicate that it is a good to excellent test for confirming the presence of rectal involvement in deep infiltrating endometriosis with the higher positive LRs from studies using transvaginal probes operating at 5-9 MHz. Six out of the eight studies demonstrated extremely high LR+, with four studies showing infinite LR+. TVS can therefore be considered to be an excellent test for detecting rectal endometriosis. Negative LRs were very low, with six out of the eight studies reporting a LR− of 0.1 or less. TVS can therefore be considered to be an excellent test for excluding the presence of rectal involvement in deep infiltrating endometriosis. The lowest negative LRs were from studies using transvaginal probes operating at 5-9 MHz rather than those operating at lower frequencies. Overall, TVS seems to be a useful imaging technique to confirm and exclude the presence

Table 2 Summary of relevant studies

Author [reference]	Study period	Study population	Age	TVS	TRS	MRI	Blinding
Abrao [10]	2004-2006	104 Consecutive women with clinically suspected endometriosis	Mean 33.8 years (SD 6.1)	HDI 5000 ultrasound scanner with 5-9MHz transducer within 3months before surgery. Rectal enema used	N/A	1.5T scanner with a Torso phase array coil. Contrast agent gadolinium 0.2mmol/kg. No bowel preparation used	TVS carried out blinded to clinical data. MRI radiologist blinded to clinical data and TVS results
Bazot [11]	2000–2004	81 Consecutive women referred for surgical management of DIE	Median 31.9 years	Ultramark HDI 5000 or Siemens Elegra ultrasound machine. 5-9MHz transducer. No bowel preparation used	Olympus GF UM 20 Echo endoscope, 7.5 and 12MHz.		Sonographers informed of women's clinical history and symptoms but blinded to physical examination and previous imaging. Different physicians performed TVS and TRS
Bazot [19]	2000–2005	Retrospective study of 92 consecutive women with clinically suspected pelvic endometriosis	Median 31.8 years	Ultramark HDI 5000 or Siements Elegra ultrasound machine, 5-9MHz transducer. No bowel preparation used	Olympus GF UM 20 Echo endoscope, 7.5 and 12MHz probe	1.5T scanner. Bowel preparation given. Contrast agent gadolinium	All examinations conducted by different physicians with knowledge of clinical history and symptoms but blind to results of physical exam and other imaging
Chamié [12]	2005-2007	92 Women with a history and clinical examination consistent with endometriosis	Mean 33 years	N/A	N/A	GE Signa 1.5T scanner. Contrast agent gadolinium. No bowel preparation used	MRI images interpreted independently by 2 radiologists blinded to patient history
Chapron [13]		Retrospective study of 81 consecutive patients with histologically proven DIE. MRI and transrectal ultrasound given prior to planned surgery	Mean 31.0 (SD6.7)	N/A	Olympus GF-UM20 scope ultrasound machine with 7.5 and 12MHz probes	1.5T Tesla Unit with a phased-array coil. No contrast aged used	Patients already had a diagnosis of DIE but the ultrasonographer and radiologist were blind to clinical information when they interpreted the results of the tests
Delpy [14]	1998–2003	31 Women with suspected rectovaginal endometriosis based on clinical symptoms and/or abnormal clinical examination	Mean 31.5 years	N/A (for rectal infiltration)	7.5MHz radial-scanning miniprobe (Fujinon) fitted with a distal balloon	N/A	Blind to precise clinical findings but with the knowledge of suspected endometriosis. Surgery conducted with full knowledge of imaging results
Guerriero [15]	2005-2007	88 Consecutive women with clinically suspected endometriosis	Mean 33 years (SD 5)	1Week before surgery using Technos MPX with 6.5-7.0MHz transducer. Paid special attention to tender areas. No rectal enema used.	N/A	N/A	Not reported
Hudelist [16]	2007–2008	200 Women with clinically suspected endometriosis	Median 33 years	Logic 9 or Accuvix XQ ultrasound machine 5-9MHz transducer combined with bimanual PV examination within			PV examination performed first followed by TVS by the same examiner

					2months of surgery. No rectal enema used			
Menada [17]	2006–2007	90 Women with clinically suspected rectovaginal endometriosis	Median 32years		Siemens Sonoline Antares ultrasound machine. 3.6-8.0MHz multifrequency transducer			
Given on day of surgery. Bowel preparation given on the day before surgery. Saline solution injected into the rectum during the procedure	N/A	N/A	TVS carried out independently by 2 ultrasonographers with the knowledge of clinically suspected disease by blind to any other clinical information					
Piketty [18]	2005–2007	134 Women with clinically suspected DIE	Mean 32.1 years (SD 5)		Toshiba ultrasound machine. 5-9MHz transducer. No rectal enema used	Olympus UM 160 following rectal enema. 5, 7.5 and 12MHz frequencies used	N/A	Examiners told DIE was suspected but were not given information on clinical findings or other imaging findings

of deep infiltrating endometriosis involving the rectum or recto-sigmoid colon (Table 3). In a clinic population where the pre-test probability of disease is 50%, we would expect the post-test probability given a positive test to be between 90% and >99%. In the same population, a negative test would reduce the probability of disease to between 5% and <1%.

Transrectal ultrasound

There were five studies [11, 13, 14, 18] investigating the diagnostic accuracy of TRS for rectal involvement in deep infiltrating endometriosis. In three of the studies, 7.5 MHz and 12 MHz probes were used and in one study only the 7.5 MHz probe was used [14]. Positive LRs were calculated for four studies and for three of them, TRS was a good test to confirm the presence of disease [11, 13, 19] all of which used 7.5 and 12 MHz probes.

In the study by Delpy [14], the LR+ was lower and this corresponded to the use of a probe operating at a lower frequency (7.5 MHz). The negative LRs generally indicated that TRS is a reasonable test for excluding disease. The negative LRs did not seem to be related to the frequency of probe used or to any other consistent methodological difference between the studies (Table 3). In a clinic population where the pre-test probability of disease is 50%, we would expect the post-test probability of disease given a positive test to be between 65% and 93%. In the same population, a negative test would reduce the probability of disease to between 9% and 3%. Although TRS is a good test for excluding disease and a reasonable test for confirming disease, it does not seem to perform better than TVS, requires a rectal enema and might be more uncomfortable than TVS.

Magnetic Resonance Imaging

Two of the studies investigating the diagnostic accuracy of MRI for rectal involvement in deep infiltrating endometriosis were prospectively conducted and included women with symptoms that lead to a clinical suspicion of endometriosis [10, 12] whilst the other two were retrospective [13, 19]. Chapron et al. [13] included only women with histologically proven deep infiltrating endometriosis whilst Bazot et al. [19] included women with clinically suspected endometriosis. Three of the studies [12, 13, 19] used gadolinium as a contrast agent for the MRI whereas Abaro et al. [10] used no contrast agent. The positive LRs ranged from 12.0 to 41.7 indicating that MRI is a very good to excellent test for confirming the presence of disease. The negative LR from was between 0.1 and 0.2 indicating that MRI is a very good test for excluding the presence of deep infiltrating rectal endometriosis (Table 3). In a clinic population where the pre-test probability of disease is 50%, we would expect the post-test probability of disease

Table 3 Summary of study results: imaging of rectal or recto-sigmoid involvement in deep infiltrating endometriosis

Study	Pre-test probability[a] (*n*)	Sensitivity% (95% CI)	Specificity% (95% CI)	LR+ (95% CI)	LR− (95% CI)	Post-test probability for study population: positive test (%)	Post-test probability for study population: negative test (%)
Transvaginal Ultrasound							
Abrao [10]	52% (54/104)	98 (95,100)	100 (100,100)	∞	0.02 (0.00, 0.1)	>99	2
Menada [17] TVS	83% (75/90)	56.5	92.5	7.57	0.47	97	60
Menada [17] RWC-TVS[b,c]	83% (75/90)	95.7	100.0	∞	0.04	>99	15
Guerriero [15]	44% (39/88)	67 (55,73)	92 (84, 100)	8.2 (3.1,21.4)	0.4 (0.2,0.6)	87	22
Bazot [11]	67% (54/81)	93 (86,100)	100 (100,100)	∞	0.07 (0.03,0.2)	>99	12
Hudelist [16]	24% (48/200)	96 (90,100)	98 (96, 100)	48.6 (15.8,149.1)	0.04 (0.01,0.2)	94	1
Piketty [18]	56% (75/134)	91 (84,97)	97 (92,100)	26.3 (6.7, 102.8)	0.1 (0.05, 0.2)	97	11
Bazot [19]	68% (63/92)	94 (88,100)	100 (100,100)	∞	0.06 (0.02, 0.2)	>99	11
Trans-rectal ultrasound							
Chapron [13]	42% (34/81)	97 (91,100)	89 (81,98)	9.1 (4.0,20.9)	0.03 (0.00, 0.2)	87	2
Delpy [14]	40% (12/40)	92 (76,100)	67 (45,88)	2.8 (1.4,5.0)	0.1 (0.02,0.8)	65	8
Bazot [11]	67% (54/81)	89 (81,97)	93 (83,100)	12.0 (3.2,45.7)	0.1 (0.06,0.3)	96	20
Piketty [18]	56% (75/134)	96 (92,100)	100 (100,100)	∞	0.04 (0.01,0.1)	>99	5
Bazot [19]	68% (63.92)	89 (81,97)	93 (84,100)	12.9 (3.4,49.2)	0.1 (0.06,0.2)	96	20
Magnetic Resonance Imaging (MRI)							
Chapron [13]	42% (34/81)	76 (62,91)	98 (94,100)	35.9 (5.1,252.1)	0.2 (0.1,0.4)	98	15
Abrao [10]	52% (54/104)	83 (73,93)	98 (94,100)	41.7 (6.0,291.1)	0.2 (0.09, 0.3)	98	16
Chamie [12]	54% (50/92)	86 (76,96)	93 (85,100)	12.0 (4.0,36.0)	0.2 (0.08, 0.3)	93	15
Bazot [19]	68% (63.92)	87 (79,96)	93 (84,100)	12.7 (3.3,48.4)	0,1 (0.07,0.3)	96	23

[a] Pre-test probability is the prevalence of deep infiltrating endometriosis involving the rectum or rectosigmoid colon.

[b] Figures published in the paper given, no data were available to construct a 2×2 table in order to calculate 95% confidence intervals

[c] RWC-TVS, water contrast in the rectum combined with TVS

given a positive test to be between 94% and 97%. In the same population, a negative test would reduce the probability of disease to approximately 9-18%. MRI is therefore a useful test to both confirm and exclude the presence of disease, although it does not appear to perform as well as TVS.

From our three tests, we can conclude that TRS is less accurate than TVS at confirming the presence of disease, but is equally accurate at excluding the presence of disease. TVS is also more slightly accurate than MRI in both confirming and excluding disease. However, MRI is significantly more expensive, and for a claustrophobic patient, considerably more traumatic than TVS, and it would therefore not seem to be beneficial to include MRI in the pre-operative assessment for this particular patient.

How would you present the evidence to Miss A?

Miss A should be counselled that although it is likely that she has endometriosis, this will need to be confirmed histologically at surgery. Nevertheless, since she has a high probability of having endometriosis, in order to prepare her adequately for surgery, it is important to determine whether she may have the disease in her bowel. She should be told that the most useful test would be a transvaginal ultrasound carried out in a specialist centre by an appropriately trained specialist. If the ultrasound examination suggests that there is rectal involvement, she has a high likelihood of requiring some bowel intervention and needs to be counselled appropriately. However, she needs to be warned that no tests are 100% accurate and therefore, even if she does have a negative test, there remains a possibility that her bowel is involved and that she is operated on in a facility that has the appropriately trained surgeons to carry out the surgery required without the need to abandon surgery and re-arrange it subsequently.

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