

Review Article

Imaging Techniques for the Diagnosis of Deep Endometriosis

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Deep endometriosis is the most complex form of endometriosis. A range of clinical symptoms that include chronic pelvic pain, dyspareunia, dyschezia and rectal bleeding characterize the condition. The method considered the gold standard for the diagnosis of deep endometriosis is laparoscopy followed by histological confirmation; nevertheless, laparoscopy fails to identify retroperitoneal lesions. On the other hand, several diagnostic options are available today including physical examination, transvaginal ultrasonography, magnetic resonance imaging, computed tomographic colonography and colonoscopy. The objective of this article is to review the most recent methods and techniques adopted in an attempt to obtain a more precise diagnosis, thus providing the patient with accurate information on the extent of the disease. Furthermore, a precise diagnosis allows the physician to plan the most appropriate treatment, be it surgical, pharmacological or a combination of both, with the exclusive aim of improving the quality of life of patients with deep endometriosis.

Keywords: Deep endometriosis; Diagnosis; Diagnostic approach; Transvaginal Ultrasonography; Magnetic resonance imaging**Introduction**

Endometriosis is characterized by the presence of endometrial tissue at ectopic sites, principally in the ovaries and uterosacral ligaments. The disease affects 10-15% of women during their reproductive life. Deep endometriosis is a specific entity characterized by the presence of lesions exceeding 5 mm in size in the peritoneum, retro cervical region (uterosacral ligaments and torusuterinus), vagina, bowel (rectum, sigmoid, ileum and appendix), rectovaginal septum (between the mid-third of the vagina and the rectum), bladder and ureters [1]. The condition is difficult to identify by clinical examination alone [2,3]. The symptoms are generally caused by inflammatory phenomena irritating the target organs, with some studies suggesting that the type of pain is an indication of the site of the pathology. For example, dysmenorrhea increases when there is infiltration of the pouch of Douglas, dyspareunia is indicative of infiltration of the uterosacral ligaments, acyclic pelvic pain and gastrointestinal symptoms are associated with bowel involvement, lower urinary tract symptoms are an indication that the bladder is affected and dyschezia during menstruation suggests vaginal involvement [4]. Currently, the greatest challenge in managing deep endometriosis is, in summary, to be able to diagnose the disease accurately and consequently implement the proposed treatment, be it surgical, pharmacological or a combination of both. Although the symptoms may correlate with the various sites of deep endometriosis [5] and vaginal examination is a satisfactory means of detecting painful nodules, physical examination remains of limited value for evaluating the extent of deep endometriosis [6]. Therefore, other imaging methods such as high-resolution transvaginal ultrasonography for the evaluation of right iliac fossa pain, transrectal ultrasonography, three-dimensional ultrasonography at the vaginal introitus and magnetic resonance imaging have been used as noninvasive means

of diagnosing this pathology [1]. Based on the assumption that a precise evaluation is fundamental in order to establish treatment and follow-up, the objective of this study was to perform a review of the literature on deep endometriosis in relation to its diagnosis. The aim was to improve the approach and management of this pathology, consequently improving the quality of life of women affected by this disease.

Review Methods

This review was based on a search of the literature, predominantly the PubMed and Cochrane Library databases, looking specifically for English-language publications dealing with the issues under investigation. The descriptors used were “deep endometriosis”, “diagnosis”, “diagnosis approach”, “transvaginal ultrasound” and “magnetic resonance”. The articles considered most relevant from a clinical point of view and those with the most appropriate scientific evidence were selected, with the reference lists of review articles also being consulted in a search for additional studies. Priority was given to more recent articles, those with a higher level of evidence, and published guidelines involving updates in diagnosis.

Methods for diagnosing deep endometriosis

Barium enema and colonoscopy: The sensitivity and specificity of barium enema and colonoscopy for a diagnosis of deep endometriosis are poor, with only indirect signals normally being shown. Since these methods evaluate only the internal surface and the circumference of the loop, they are only able to detect mucosal lesions.

Computed tomography: Computed tomography is able to evaluate the thickness of the wall; however, it cannot distinguish between various soft tissues. In addition, differentiating and delineating the pelvic organs and their lesions is difficult. Computed

tomographic colonography is another diagnostic method used to determine whether lesions have invaded the bowel. It permits evaluations other than those offered by traditional colonoscopy, with views of the sub mucosa and serosa [1]. With this technique, a large obstetric tampon is inserted into the vagina and a Foley catheter releasing CO₂ is placed in the rectum. The entire pelvis is then scanned. This method is fast (around 20 minutes), non-invasive and requires no sedation. The great advantage lies in the CO₂ insufflation, which permits multiple evaluations to be made of the bowel, urinary tract and retroperitoneal regions. Appropriate for young women, this technique has the benefit of avoiding high doses of radiation while undergoing complete evaluation in one single assessment [7]. More recently, computed tomography enema has been used to identify multifocal lesions (multiple endometriotic lesions affecting the same segment) or multicentric lesions (endometriotic lesions affecting different segments of the digestive tract); however, results remain controversial. Belghiti et al. evaluated the contribution of computed tomography enema and magnetic resonance imaging for the diagnosis of multifocal or multicentric lesions of endometriosis in the bowel. Although accuracy was high with both methods, the authors concluded that the value of these techniques remains limited when multifocality or multicentricity is under investigation [8].

Ultrasonography and magnetic resonance imaging

Transvaginal ultrasonography is widely available, well accepted and extremely accurate. Therefore, it is considered the method of choice for the identification of lesions of deep endometriosis, particularly those located in the pelvis [9-11]. Nevertheless, when not performed by a trained specialist, there are limitations insofar as examination of the rectosigmoid junction is concerned, thus justifying the complementary role of magnetic resonance imaging for the identification of possible endometriotic lesions at that site [12,13].

Bowel, Retro cervical and vaginal endometriosis

The size and the number of lesions, the layers of the affected bowel wall, the circumference of the affected loop and the distance from the anal verge are all relevant factors and should be determined when examining these regions [14,15]. Transrectal ultrasonography (TRUS) is considered an important, highly effective tool for the diagnosis of infiltrating endometriosis of the bowel wall. This method is extremely accurate for determining the size and the number of lesions, as well as their distance from the anal verge; however, there are limitations with respect to its ability to diagnose infiltration into the sub mucosal layer. The main disadvantage of transrectal ultrasonography in relation to the other methods is that it allows only the rectosigmoid and adjacent sites to be evaluated and is not appropriate for foci of endometriosis in the appendix, ileum, ovaries or bladder. In addition, assessing the percentage to which the loop is affected is difficult and always depends on the transducer that is being used. Preference should be given to radial, multiplane or three-dimensional probes [16]. Transvaginal ultrasonography with prior bowel preparation permits visualization of endometriotic lesions in the pelvic region (vesicouterine space, retro cervical region, bladder, vaginal fornix and anterior rectal wall) in addition to extra-pelvic regions such as the abdominal portion of the sigmoid, the transverse and ascending colon, appendix and the ureters, both in their abdominal and pelvic segments [17]. Transvaginal sonography with prior bowel preparation is an excellent method for evaluating the size of bowel lesions, and

allows the circumference of the affected loop to be calculated [16]. Sensitivity is 81% and specificity 99% for determining the existence of more than one nodule in the rectosigmoid. To evaluate the extent to which the layers are affected, sensitivity and specificity are 100% when infiltration extends at least as far as the muscularis propria and 83% and 94%, respectively, when infiltration includes the sub mucous and mucous layers [14]. In 2014, Leon et al. reported satisfactory results for the diagnosis of deep endometriosis using a new technique referred to as extended transvaginal sonography (evaluation of the anterior and posterior compartments associated with prior bowel preparation and intra vaginal gel). Those investigators used the same technique previously described by Gonçalves et al. [17], but without abdominal ultrasonography, to identify lesions of deep endometriosis [18]. In 2007, Guerriero et al. developed a new modality of ultra sonographic evaluation referred to as "tenderness-guided" ultrasonography in which an acoustic window is created between the vaginal probe and the adjacent vaginal structures by increasing the amount of ultrasound transmission gel inside the probe cover. As the patient reports pain or discomfort in response to the pressure of the probe at certain sites, the ultrasound operator is then able to concentrate on that particular site when seeking possible endometriotic nodules. With this technique, those authors obtained specificity of 95% and sensitivity of 90%, suggesting that it may represent a new low-cost option for identifying endometriosis [19]. In 2008, that same group evaluated the diagnostic accuracy of the same technique for the identification of different sites of deep endometriosis. Five sites were evaluated: the vaginal wall, rectovaginal septum, rectosigmoid, uterosacral ligaments and the anterior compartment. Sensitivity and specificity were high for the detection of vaginal endometriosis (sensitivity of 90% and specificity of 89%) and for endometriosis of the rectovaginal septum (sensitivity of 74% and specificity of 88%). Specificity was good (92-100%) for endometriosis of the uterosacral ligaments, rectosigmoid and anterior compartment; however, sensitivity was poor (33-67%) [20]. Another option that can be included during transvaginal ultrasonography is the sliding sign. This technique consists of pressing the transducer towards the posterior vaginal fornix and withdrawing it backwards to assess the movement of the rectum against the posterior vaginal fornix and the posterior uterine wall. The operator simultaneously exerts external pressure against the uterus by placing one of his/her hands on the patient's abdomen. If there is no movement, the sliding sign is considered negative, suggesting the presence of adhesions [21]. Reid et al. evaluated the use of this technique for the identification of deep endometriosis located in the Douglas pouch. The negative sliding sign was found to be indicative of endometriosis, with sensitivity of 83.3%, specificity of 97.1% and accuracy of 93%; therefore, this can be considered a valuable technique for identifying endometriosis at the above-mentioned site [22]. In 2010, Grasso et al. evaluated the role of three-dimensional (3-D) ultrasonography as a pre-surgical method of diagnosing deep endometriosis. The authors found sensitivity to be inexplicably low with this method for identifying endometriosis of the uterosacral ligament (around 50%) and rectosigmoid (33.3%) [23]. Other investigators evaluated the use of 3-D ultrasonography for the sole purpose of diagnosing endometriosis of the rectovaginal septum and reported specificity of 94.7% and sensitivity of 89.5% [24,25]. Although it is gaining in popularity in clinical practice and has been proven to be effective for the diagnosis of endometriosis of the rectovaginal septum, 3-D ultrasonography (with the transducer

placed at the perineum) requires further evaluation to verify the validity and applicability of the method for the detection of lesions of deep endometriosis [26]. Recently, a novel mapping of pelvic endometriosis based on transvaginal ultrasonography was produced. This mapping resulted in a detailed list of possible endometriosis lesions. That study showed that ultra sonographic evaluation prior to surgery, when conducted by an experienced professional, is able to provide extremely accurate information on the presence and on the precise site of lesions, giving the surgeon detailed information on the true extent of deep endometriosis [27]. In summary, transvaginal ultrasonography is effective for reaching a diagnosis in women with signs and symptoms of deep endometriosis. Although highly dependent on the experience of the professional, it should be the method of choice [28]. Magnetic resonance imaging is now known to be as accurate as transvaginal ultrasonography for the identification of bowel nodules and for calculating their distance from the anal verge; however, it is not as good as ultrasonography when the objective is to evaluate the number of lesions and the layer affected [14]. To evaluate the terminal ileum and appendix, ultra sonographic evaluation of the right iliac fossa and pelvis by trans abdominal and transvaginal ultrasonography is the method of choice, since magnetic resonance imaging and computed tomography are less accurate for the detection of lesions at those sites [17]. The methods most commonly used to detect nodules of endometriosis in the vagina are transvaginal ultrasonography and magnetic resonance imaging, both performed with the use of gel to facilitate visualization of the lesions and to evaluate the degree of infiltration, thus providing the surgeon with the information required for the surgical procedure [17].

Urinary tract

To evaluate lesions of the urinary tract, methods such as magnetic resonance imaging and ultrasonography (abdominal or transvaginal) are used to identify hydronephrosis or infiltration of the detrusor muscle, signs that are important when planning treatment [17]. Nevertheless, since it is inexpensive, widely available and does not involve the use of radiation, abdominal ultrasonography is the method of choice. Complementing the Transabdominal scan with transvaginal ultrasonography increases the diagnostic accuracy, with specificity and sensitivity close to 100% for bladder endometriosis [17]. The characteristic finding consists of a solid nodule, particularly in the bladder dome or posterior wall [23]. The first diagnostic method evaluated for bladder endometriosis was transvaginal ultrasonography, with a study reporting 71% and 100% of sensitivity and specificity, respectively [29]. Magnetic resonance imaging was then evaluated, with results showing sensitivity of 88% and specificity of 99% for this type of lesion, with high signal intensity on T1-weighted images and low signal intensity on T2-weighted images [30]. Cystoscopy can also be used to diagnose bladder endometriosis; however, since the lesions are of intraperitoneally origin, in many cases findings are normal. The accuracy of this method for identifying bladder lesions was 30%; however, only in the case of single lesions, rarely for multiple lesions [31]. The morphology of the lesions of bladder endometriosis can vary in accordance with the menstrual cycle and they are more easily identified during menstruation. They may appear as reddish, bluish, chocolate brownish or even black lesions. As a rule, the urothelium is rarely ulcerated [32]. Biopsy has been conducted to perform a differential diagnosis between endometriosis of the bladder and urothelial carcinoma, hyperactive

bladder, interstitial cystitis (bladder pain syndrome) and urethral syndrome [33]. Excretory urography is the recommended method for evaluating whether the ureters are affected; however, small bladder lesions may be missed [33].

Conclusion

The symptoms of deep endometriosis vary greatly from patient to patient; therefore, clinical diagnosis is highly challenging. Today, a wide range of diagnostic methods is available to help clarify diagnosis, providing patients with more accurate information on the extent of the disease as well as the proposed treatment options. Initially, transrectal ultrasonography was the most commonly used method for evaluating the rectosigmoid; however, various studies have now shown that transvaginal ultrasonography should be the method of choice, since sensitivity and specificity are high and the method is more cost-effective. Magnetic resonance imaging and computed tomographic colonography may represent additional options for the identification of endometriotic lesions. Most of the articles published in the literature refer to the use of transvaginal ultrasonography without prior bowel preparation; however, there are studies demonstrating that this procedure increases the likelihood of assessing multiple nodules accurately, identifying the layers affected and determining the distance from the anal verge. Physicians are thus provided with the information they require to be able to select the best treatment strategy, be it surgical, pharmacological or a combination of both.

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