

Is it time to include assessment of the most common gynaecological condition in the routine ultrasound evaluation of the pelvis?

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Endometriosis is defined by the presence of endometrial glands and stroma outside the uterus¹. The most common hypothesis assumes endometrial glands and stroma implant in the pelvis after retrograde menstruation through the fallopian tubes. While retrograde menstruation happens in the majority of women, only 5–10% of women will develop endometriosis². The real cause of endometriosis remains unclear. It is likely that genetic, biological and environmental factors all play a role. Approximately 80% of women suffering from endometriosis will develop superficial lesions while 20% will develop deep endometriosis (DE)³. DE is characterised by lesions that penetrate under the surface of the peritoneum by more than 5 mm³ mainly in the uterosacral ligaments (USL), rectosigmoid, rectovaginal septum or bladder. DE can be associated with significant adhesions between the uterus and ovaries and bowel causing obliteration of the pouch of Douglas (POD). The associated symptoms are usually, but not always, more severe. Therapy of DE is significantly more complex and requires a multidisciplinary approach consistent with current recommendations of the World Endometriosis Society (WES)⁴ and the European Society for Human Reproduction (ESHRE)⁵.

Transvaginal ultrasound (TVUS) is considered an essential tool for the assessment of pelvic pathology and is often used as a first-line investigation for women with gynaecological symptoms. Initially, only pathologies of the uterus and ovaries could be assessed but with improvements in equipment and particularly the development of specific skills and scanning techniques, it has also become possible to diagnose other gynaecological disorders affecting structures beyond the uterus or ovaries such as DE. It is now time to consider why the transvaginal ultrasound assessment of DE (DE-TVUS) should become an essential part of every routine gynaecological ultrasound examination.

Is DE-TVUS important enough?

Endometriosis is a common and often debilitating gynaecological disorder that affects 5–10% of women². The prevalence is even higher among women with symptoms of endometriosis² which include chronic pelvic pain, acquired dysmenorrhoea, dyspareunia (pain with sexual intercourse), dyschezia (pain with defecation), menorrhagia, abnormal bleeding and infertility. It can cause major morbidity and compromised quality of life. It is estimated that more than 700,000 Australian women are living with endometriosis, approximately 176 million women worldwide. It is reported to cost more than 7.7 billion per year in health care, absenteeism and lost social and economic participation in Australia⁶. Certainly, it is a condition worth looking for.

The lack of awareness for endometriosis among the medical community and the public is now well documented. The delay between onset of symptoms and diagnosis is on average 7 years⁷. The fact that period pain is still often considered normal, that symptoms can vary significantly from person to person, and that a diagnostic laparoscopy, an invasive procedure, is required for formal diagnosis may all contribute to this delay. Although there is currently no cure for endometriosis and symptoms often recur after medical and surgical treatment, it is recognised that early diagnosis and intervention can lead to better long-term management.

Laparoscopy remains the gold standard for the diagnosis of endometriosis, and when superficial lesions are seen during this diagnostic laparoscopy, these can often be removed during the same procedure. However, when DE is found unexpectedly, a repeat procedure is often required. More theatre time may be needed, or a referral to a specialist with more expertise in advanced laparoscopic surgery may be required. A multidisciplinary approach needs to be considered with the involvement of a urologist or a colorectal surgeon, particularly when pouch of Douglas obliteration, bowel nodules or bladder nodules are present. The pre-operative diagnosis of DE with transvaginal ultrasound thus facilitates a more patient-centred approach to endometriosis management because an accurate pre-operative documentation of the location and extent of the disease allows

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for better pre-operative planning, less repetitive surgery and better outcomes for women.

Is DE-TVUS mature enough?

The technique to detect DE with transvaginal ultrasound was first presented in Australia in 2008 at the World Endometriosis Conference in Melbourne by Mauricio Abrao, who subsequently published a detailed description of this technique in 2009⁸. Their first publication of the detection of rectosigmoid endometriosis in 2007 had shown a sensitivity of 98%, a specificity of 100%, a PPV of 100%, a NPV of 98% and accuracy of 99%. Since then, the accuracy of TVUS for the prediction of rectosigmoid DE has been well established in the literature. Guerriero *et al.*⁹ published a systematic review in 2016 which included 19 prospective and retrospective studies. Overall pooled sensitivity and specificity for detecting DE in the rectosigmoid with TVUS were 91% (95% CI, 85–94%) and 97% (95% CI, 95–98%), and positive likelihood ratio (LR+) and negative likelihood ratio (LR–) were 33.0 (95% CI, 18.6–58.6) and 0.10 (95% CI, 0.06–0.16), respectively. The accuracy, sensitivity, specificity, PPV, NPV, LR+ and LR– for the assessment of the ‘sliding sign’ in the prediction of POD obliteration have been demonstrated to be 95%, 85%, 98%, 93%, 95%, 40.3 and 0.15, respectively¹⁰. Test characteristics of TVUS detection of rectovaginal septum, uterosacral ligaments, vaginal vault and bladder are not as excellent but also fair.¹¹ For the detection of endometriosis in the uterosacral ligament (USL), the overall pooled sensitivity and specificity of TVUS were 53% and 93%. The pre-test probability of USL endometriosis was 54%, which increased to 90% when suspicion of endometriosis was present after TVUS examination. For the rectovaginal septum (RVS), the overall pooled sensitivity and specificity were 49% and 98%. The pre-test probability of RVS endometriosis was 24%, which increased to 89% when suspicion of endometriosis was present after TVUS examination. For vaginal endometriosis, the overall pooled sensitivity and specificity were 58% and 96%. The pre-test probability of vaginal endometriosis was 17%, which increased to 76% when suspicion of endometriosis was present after TVUS assessment. For bladder endometriosis, the overall pooled sensitivity and specificity were 62% and 100%. The pre-test probability of bladder endometriosis was 5%, which increased to 92% when suspicion of endometriosis was present after TVUS assessment¹¹.

Based on many studies looking at the diagnostic accuracy of DE-TVUS, it is fair to conclude that the technique is valid.

Is DE-TVUS easy enough to learn?

In 2016, the International Deep Endometriosis Analysis (IDEA) group published a consensus paper¹² outlining a recommended sonographic approach when examining women with suspected endometriosis. The IDEA consensus promotes a 4-step dynamic ultrasound approach. The first step involves the routine evaluation of uterus and adnexa with particular attention

for sonographic signs of adenomyosis and the presence or absence of endometriomas. The second step involves the evaluation of transvaginal sonographic ‘soft markers’ such as site-specific tenderness and ovarian mobility. The third step is assessment of status of POD using the real-time ultrasound-based ‘sliding sign’, and the last step is the assessment of DE nodules in the anterior and posterior compartments. This last step involves assessment of the bladder, vaginal vault, uterosacral ligaments and bowel including rectum, rectosigmoid junction and sigmoid colon. In 2018, Jing Fang published a free pictorial article in *Sonography* providing practical and illustrated guidance on how to perform this multistep sonographic evaluation of DE with key reference made to the IDEA consensus paper¹³ making the technique even more accessible to all interested Australian sonographers.

The learning curve for experienced imaging specialists to master the ultrasound technique to detect DE with live scanning has been shown to vary between 33 and 42 scans for the detection of POD obliteration, and 36–42 scans were required to achieve competency for the detection of bowel nodules^{14,15}. Menakaya *et al.*¹⁶ assessed the learning curve for predicting POD obliteration with offline videos of the real-time dynamic sliding sign and showed that performance of a minimum number of gynaecological ultrasound examinations is necessary for interpreting the sliding sign and predicting POD obliteration. Non-specialist observers with prior experience of 200 or more gynaecological scans were more consistent in interpreting the sliding sign at the retrocervix versus the posterior uterine fundus. A training programme that combined use of real-time ultrasound and evaluation of offline 3D volumes showed that trainees reached competence on average after 17 evaluations (range 21–14) for bladder locations, after 39 evaluations (range 60–30) for rectosigmoid locations, after 25 evaluations (range 34–14) for forniceal locations, after 44 evaluations (range 66–25) for uterosacral locations (USL) and after 21 evaluations (range 43–14) for rectovaginal septum (RVS)¹⁷. In terms of the reproducibility of TVUS for the prediction of DE, Tammaa *et al.*¹⁸ demonstrated a high interobserver agreement between two experienced gynaecological sonologists for the prediction of vaginal, bladder, USL and bowel DE.

Summing up

Despite good test characteristics and an acceptable learning curve, even after 12 years, the ultrasound assessment of DE is still considered a specialist assessment. Even though a ‘PCO assessment’, a ‘polyp assessment’, a ‘fibroid assessment’ and an ‘ovarian cyst assessment’ are all part of a routine examination, this is not the case for an ‘endometriosis assessment’. Consequently, women who are currently referred for an ‘endometriosis assessment’ are usually referred after a diagnostic laparoscopy has already demonstrated DE. This is unfortunate as transvaginal ultrasound is widely available in Australia and used as a first line of investigation for women with

gynaecological symptoms. For women in the reproductive age group, common indications for referral are pelvic pain, abnormal bleeding and infertility. Endometriosis is a differential diagnosis to be considered for all these indications. It is well known that ultrasound is not able to detect all pelvic endometriosis with enough accuracy that it can replace surgery because superficial lesions cannot be diagnosed with ultrasound. But unless the ultrasound examination is extended beyond the uterus and ovaries into the posterior and anterior pelvic compartments to evaluate structural mobility and to look for deep endometriotic nodules, DE will continue to be missed which denies affected women a pre-operative diagnosis and an opportunity of having a single, well-planned procedure in the hands of a well-prepared team.

Of the top ten research priorities for endometriosis in the UK and Ireland published in the *Lancet* in 2017, the fourth and sixth research priorities involve the improvement of a non-invasive diagnosis¹⁹. Endometriosis is an incurable chronic condition which in its more severe forms exacts an enormous toll on the women suffering from it, their partners and family and the broader community. Despite an estimated prevalence similar to that of diabetes, Crohn's disease and rheumatoid arthritis, it has been under-recognised and under-diagnosed for a very long time.

In a laudable effort to change this, Health Minister Hunt launched the National Action Plan for Endometriosis in July 2018, acknowledging and hoping to address the need for improved awareness, education, diagnosis, treatment and research into endometriosis and the associated chronic pelvic pain⁶. The imaging community now has a chance to step up to the challenge to make a significant contribution to the earlier diagnosis and the improved management of all women with DE. Rather than focussing on the further fine-tuning of an already accurate technique, more effort should go towards providing access to DE-TVUS training and advocacy to adopt the assessment of DE in the routine gynaecological ultrasound assessment.

References

- 1 Bulun SEMD. Endometriosis Mechanisms of Disease. *New Engl J Med* 2009; 360(3): 268–79.
- 2 Prescott J, Farland LV, Tobias DK, Gaskins AJ, Spiegelman D, Charvarro JE, *et al.* A prospective cohort study of endometriosis and subsequent risk of infertility. *Hum Reprod* 2016; 31(7): 1475–82.
- 3 Koninckx RP, Martin RD. Treatment of deeply infiltrating endometriosis. *Curr Opin Obstet Gynecol* 1994; 6(3): 231–41.
- 4 Johnson NP, Hummelshoj L, World Endometriosis Society Montpellier C. Consensus on current management of endometriosis. *Hum Reprod* 2013;28(6):1552–68.
- 5 Dunselman GA, Vermeulen N, Becker C, Calhaz-Jorge C, D'Hooghe T, De Bie B, *et al.* ESHRE guideline: management of women with endometriosis. *Hum Reprod* 2014; 29(3): 400–12.
- 6 National Actionplan for Endometriosis – Department of Health – Australia. Canberra, 2018. Available from: [http://www.health.gov.au/internet/main/publishing.nsf/Content/58AD1EF08402AC9FCA2582D5001A271E/\\$File/National%20Action%20Plan%20for%20Endometriosis.pdf](http://www.health.gov.au/internet/main/publishing.nsf/Content/58AD1EF08402AC9FCA2582D5001A271E/$File/National%20Action%20Plan%20for%20Endometriosis.pdf)
- 7 Nnoaham KE, Hummelshoj L, Webster P, d'Hooghe T, de Cicco Nardone F, de Cicco Nardone C, *et al.* Impact of endometriosis on quality of life and work productivity: a multicenter study across ten countries. *Fertil Steril* 2011;96(2):366–73.
- 8 Goncalves MO, Dias JA Jr, Podgaec S, Averbach M, Abrao MS. Transvaginal ultrasound for diagnosis of deeply infiltrating endometriosis. *Int J Gynaecol Obstet* 2009; 104(2): 156–60.
- 9 Guerriero S, Ajossa S, Orozco R, Perniciano M, Jurado M, Melis GB, *et al.* Accuracy of transvaginal ultrasound for diagnosis of deep endometriosis in the rectosigmoid: systematic review and meta-analysis. *Ultrasound Obstet Gynecol* 2016; 47(3): 281–9.
- 10 Reid S, Lu C, Condous G. Can we improve the prediction of pouch of Douglas obliteration in women with suspected endometriosis using ultrasound-based models? A multicenter prospective observational study. *Acta Obstet Gynecol Scand* 2015; 94(12): 1297–306.
- 11 Guerriero S, Ajossa S, Minguez JA, Jurado M, Mais V, Melis GB, *et al.* Accuracy of transvaginal ultrasound for diagnosis of deep endometriosis in uterosacral ligaments, rectovaginal septum, vagina and bladder: systematic review and meta-analysis. *Ultrasound Obstet Gynecol* 2015; 46(5): 534–45.
- 12 Guerriero S, Condous G, van den Bosch T, Valentin L, Leone FP, Van Schoubroeck D, *et al.* Systematic approach to sonographic evaluation of the pelvis in women with suspected endometriosis, including terms, definitions and measurements: a consensus opinion from the International Deep Endometriosis Analysis (IDEA) group. *Ultrasound Obstet Gynecol* 2016; 48(3): 318–32.
- 13 Fang J, Piessens S. A step-by-step guide to sonographic evaluation of deep infiltrating endometriosis. *Sonography* 2018; 5(2): 67–75.
- 14 Piessens S, Healey M, Maher P, Tsaltas J, Rombauts L. Can anyone screen for deep infiltrating endometriosis with transvaginal ultrasound? *Aust N Z J Obstet Gynaecol* 2014; 54(5): 462–8.
- 15 Tammaa A, Fritzer N, Strunk G, Krell A, Salzer H, Hudelist G. Learning curve for the detection of pouch of Douglas obliteration and deep infiltrating endometriosis of the rectum. *Hum Reprod* 2014; 29(6): 1199–204.
- 16 Menakaya U, Infante F, Lu C, Phua C, Model A, Messyne F, *et al.* Interpreting the real-time dynamic 'sliding sign' and predicting pouch of Douglas obliteration: an interobserver, intraobserver, diagnostic-accuracy and learning-curve study. *Ultrasound Obstet Gynecol* 2016; 48(1): 113–20.
- 17 Guerriero S, Pascual MA, Ajossa S, Rodriguez I, Zajicek M, Rolla M, *et al.* Learning curve for the ultrasonographic diagnosis of deep endometriosis using a structured off-line training program. *Ultrasound Obstet Gynecol* 2018. <https://doi.org/10.1002/uog.20176>. [Epub ahead of print].
- 18 Tammaa A, Fritzer N, Lozano P, Krell A, Salzer H, Salama M, *et al.* Interobserver agreement and accuracy of non-invasive diagnosis of endometriosis by transvaginal sonography. *Ultrasound Obstet Gynecol* 2015; 46(6): 737–40.
- 19 Horne AW, Saunders PTK, Abokhrais IM, Hogg L. Top ten endometriosis research priorities in the UK and Ireland. *Lancet* 2017; 389(10085): 2191–2.