Non-Invasive Imaging Modalities for Early Diagnosis and Treatment of Endometriosis

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BACKGROUND

- Endometriosis is a condition prevalent in 8% of women where endometrial tissue of the uterus grows outside of the uterus and inside the uterine cavity, causing severe chronic pain and inflammation.
- Diagnosis is delayed an average of 7-8 years due to accessibility issues, nonspecific presentations, dismissive providers, or lack of standardized approach to identification.
- There are currently 22 existing methods of identification, but the most used systems are the American Society of Reproductive Medicine (ASRM) scoring (Figure 4) and Endometriosis Foundation of America (EFA) classification (Figure 1).
- With diagnostic delay, growths can increase in severity, making it more difficult to treat
- Laparoscopy is the standard of identification, allowing for histological confirmation, but is an invasive procedure.

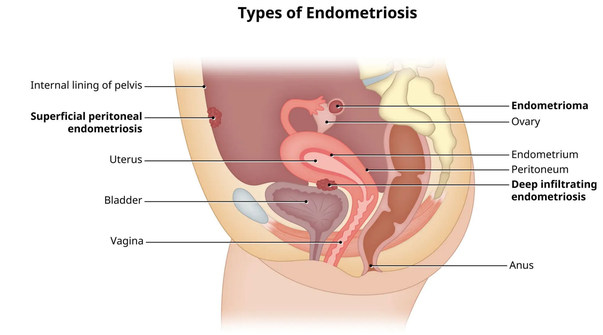


Figure 1: The Endometriosis Foundation of America (EFA) classification based on types and stages of growth. Growths can be identified as Superficial Peritoneal Endometriosis (SPE), Ovarian Endometrioma (OMA), and Deep Infiltrating Endometriosis (DIE) using the EFA classification.

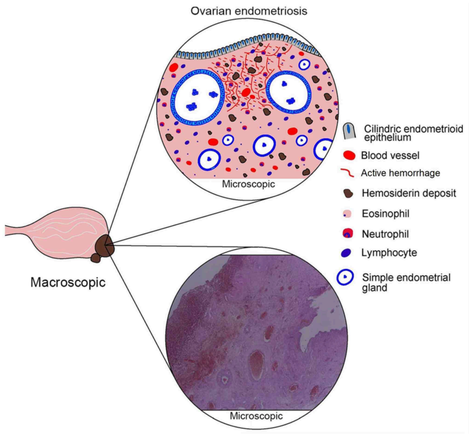


Figure 2: Microscopic histological depiction of ovarian endometrial growths on ovarian tissue collected from a laparoscopic procedure. (Gaia-Oltean et al. 2021).

METHODS

To evaluate the accuracy in identification of deep infiltrating endometriosis by non-invasive techniques, a literature review of 18 primary scientific articles was done. Studies were collected from various medical journals.

ALTERNATIVE IDENTIFICATION METHODS

- **Transvaginal Ultrasound** (TVUS) can observe shape, position, size, fluids, blood flow in organs. TVUS is the most accessible method of endometriotic cell identification, with no post procedure effects. However, this method is not able to identify stage or depth of growths. TVUS accuracy varies by location and has higher rates of false positives. Utilizing a saline contrast with TVUS increases precision in identification.
- **Magnetic Resonance Imaging (**MRI) creates precise 3D images with a magnetic field. MRI provides precise topographic information for lesions greater than 4cm in size, however, different types of abnormal growths tend to appear homogeneously on the images. This method also provides limitations in accessibility.
- **Elastosonography** can evaluate the elasticity of organs. In DIE, scar tissue is a commonly observed trait within the uterine cavity, which can be mapped with elastosonography. Research has indicated that this method has identified lesions that were missed in MRI or TVUS and gives clear topographic outlines of fibrotic scar tissue. However, this method raises questions of accessibility.

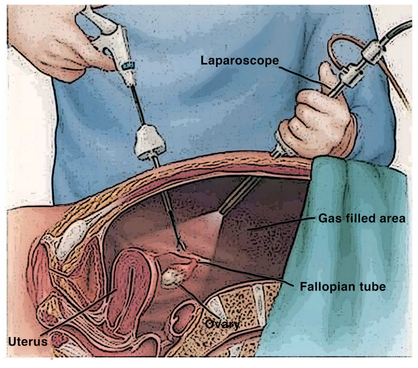


Figure 3: Laparoscopic surgery is pictured, where a small incision is made in the abdomen and a laparoscopic camera is inserted. A layer of tissue is then excised where abnormal growths are observed, and endometriotic cell identities are confirmed via microscopy. Statesboro Women's Health Specialists. (n.d.). Laparoscopic Surgery for Endometriosis. Retrieved from https://statesboro.com/blog-1/laparoscopic-surgery-for-endometriosis.

THE CURRENT GOLD STANDARD

- The current gold standard is laparoscopy, an invasive surgery utilized for endometriotic cell identification.
- After histological confirmation, infected tissue is removed with enough structural support for the organ to grow. However, without precise imaging pre-surgery, accuracy of excision of infected tissue is not possible.
- Considering that the identification and ablation of endometriotic lesions are done in the same procedure, this establishes a technique that is invasive, expensive, inaccessible, and highly in demand as the gold standard of diagnosis.
- This prolongs the wait time for patients to be diagnosed and treated, allowing for progression of the condition to more invasive levels and worsening of symptoms.

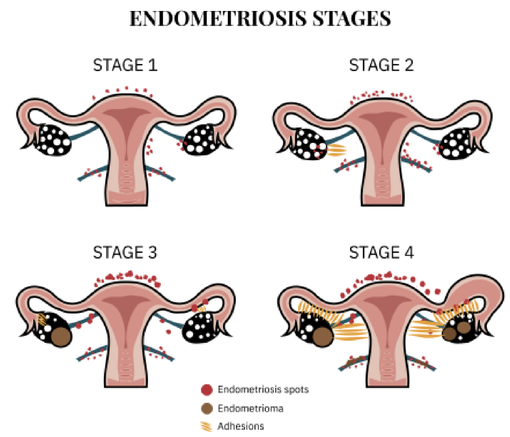
CONCLUSIONS

- By combining methods of imaging modalities, diagnostic shortcomings can be addressed. Combining methods limits user error and corroborates diagnosis.
- When MRI or TVUS is utilized with elastosonography, evaluations on depth, size, lesion stiffness, and stage of growths can be collected.
- This would allow standardization of endometriosis identification, permit easier communication between clinicians, and provide more accessible methods in reaching a working diagnosis while patients receive treatment and wait for excision procedures.

CONTINUED RESEARCH

- Investigate the efficacy in identifying less severe forms of endometriosis, not just DIE.
- Continued research should include marginalized populations, not just white affluent female populations.
- Continued research also requires focus on the etiology of endometriosis.

Figure 4: The American Society of Reproductive Medicine (ASRM) score for assigning values to lesions, corresponding to lesion size and location of lesions. Stage 1 describes minimal lesions and is the least severe stage of endometriosis, while Stage 4 corresponds to the most severe stage with many deep implants and adhesions. Big Fertility Project. (n.d.). Endometriosis Fertility Index. Retrieved from https://bigfertilityproject.com/endometriosis-fertility-index/.



REFERENCES

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