ENDOMETRIOSIS REDUX: A REVIEW OF THE USUAL AND UNUSUAL MANIFESTATIONS WITH PATHOLOGICAL CORRELATION

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Disclosure Statement

All presenters have no significant interest/arrangement with any organization(s) that could be perceived as a real or apparent conflict of interest with the subject matter of the presentation.
Learning Objectives

1. Review the pathophysiology of endometriosis.

2. Provide a pictorial review of different manifestations of endometriosis with relevant pathology and surgical examples.

3. Demonstrate the utility of imaging in the diagnosis and treatment of endometriosis.

Our target audience includes radiologists, gynecologists, oncologists and more.
Pathophysiology

• Endometriosis is defined as the presence of functional endometrial glands and stroma outside the uterine cavity. It is a common and important gynecologic disorder that primarily affects women of reproductive age.

• Approximately 1% of women with endometriosis develop an endometriosis-associated neoplasm.

• Radiologists play a key role in recognizing the malignant transformation of ovarian and extra-ovarian endometriosis.

• Preoperative recognition of these malignancies allows appropriate oncologic work-up and treatment and avoidance of errors in management.
The standard treatment for endometrial extensions is complete surgical excision and therefore accurate diagnosis and the precise localization are essential prerequisites for successful outcomes.

In addition to clinical evaluation and sonography, MRI is highly accurate in the diagnosis of endometriosis and also possesses a huge advantage over other imaging modalities in that it allows a complete survey of the pelvic compartments.
Endometriosis

• The manifestations of endometriosis commonly present a challenge to the gynecologist and radiologist. Familiarity with its varied presentations may allow accurate diagnosis.

• This presentation reviews the imaging spectrum of endometriosis, less common sites of involvement as well as the potential rare complications.

• Relevant surgical and histopathological correlation is also provided.
Scar Endometriosis

- Endometriosis can occur in scars related to prior abdominopelvic surgery.

- Deposits can be located in subcutaneous tissues and the abdominal wall musculature, as well as in the uterine scar.

- Cervical involvement maybe seen with prior cone biopsy and cautery.

- Sonographic features are variable; however, the typical endometriotic nodule is hypoechoic with scattered hyperechoic strands.

- Contrast enhanced MRI with evidence of subacute hemorrhage greatly increases specificity.
Figure 1: (A) Axial contrast enhanced CT demonstrating enhancing nodule along the surgical scar (red arrow). (B) Axial grayscale ultrasound showing a hypoechoic nodule along the surgical incision. (C) Microscopic appearance showing islands of benign endometrial glands and stroma within fibro adipose tissue.
Scar Endometriosis

Figure 2: (A) Axial pre- and (B) post-contrast T1-weighted MRI showing a hyper intense, enhancing nodule along the lateral surgical scar (red arrows). Also note the susceptibility artifact along the surgical scar (blue arrow).
Endometriosis

• Deep or solid endometriosis is typically found in the rectovaginal septum and fibromuscular pelvic structures such as the uterine ligaments and the muscular walls of pelvic organs.

• Endometrial glands can incite smooth muscle proliferation and fibrotic reaction.

• Bowel endometrial implants are usually serosal but can erode through the subserosal layers, with thickening and fibrosis of the muscularis propria.

• Commonly affected areas are the recto sigmoid colon, appendix, cecum, and distal ileum.
Endometriosis

- Endometrial implants also involve the urinary tract. The bladder is involved in most cases, followed by the distal ureters, the kidney, and the urethra.

- CT and MRI is usually recommended for detecting endometriotic implants of the urinary bladder.

- Endometriotic deposits along the distal ureters may lead to hyperplasia and fibrosis. This in turn may cause ureteric strictures resulting in hydronephrosis.
Deep Pelvic Endometriosis

Figure 3: (A) Axial pre-contrast T1-weighted image showing serosal implant with internal hemorrhage. (B) Parasagittal T2-weighted MRI depicting an implant along the serosal surface of the uterus. (C) Photo micrograph showing benign endometrial glands and hemorrhage along the serosal surface of the uterus.
Figure 4: (A) Coronal and (B) axial CT show smooth circumferential left peri ureteral soft tissue thickening along the left pelvic sidewall (red arrows) causing upstream collecting system dilatation (blue arrow). (C) Photo micrograph showing endometrial glandular tissue and hemosiderin laden macrophages consistent with endometriosis.
Deep Pelvic Endometriosis

Figure 5: Axial (A) and sagittal (B) CT show scarring from endometriosis (C) Photo micrograph shows one small glandular structure lined by stratified columnar epithelium. Although endometrial type stroma and hemosiderin pigmentation is not noted in this area, the overall findings in the case are consistent with previous endometriosis with associated inflammatory and reactive changes.
Figure 6: (A) T1-weighted axial pre-contrast image showing a serosal endometriotic implant with internal foci of hemorrhage. (B) T1-weighted coronal post-contrast image demonstrating the endometriotic implant on the serosal surface of cecum with extension to abdominal wall. (C) Microscopic appearance of benign endometrial glands and stroma along the abdominal wall. (D) Intraoperative depiction of serosal implant (yellow arrow) on the cecum (blue arrow).
Endometrioma

• MRI is now a useful adjunct to ultrasound in the detection of endometriomas.

• On MRI, endometriomas generally appear homogeneous with high signal intensity on T1-weighted images and characteristically low signal on T2-weighted images, which is referred to as “T2 shading”.

• The loss of signal on T2-weighted images results from the presence of high concentrations of protein and iron in these cysts and again reflects the chronic nature of endometriomas and cyclic bleeding.

• Heterogeneous signal intensity may result from varying ages of the contained blood products.

• Endometriomas tend to have higher T1 and lower T2 signal intensities than hemorrhagic cysts. The degree of T1 and T2 shortening is attributed to their higher protein concentration and viscosity.
Figure 7: (A) Sagittal grayscale ultrasound showing cystic lesion with uniform low level internal echoes. (B) Color Doppler shows no internal vascularity. (C, D) Photo micrographs showing ciliated and secretory fallopian tube epithelium with ectopic endometrial glands and stroma.
Figure 9: (A) Axial T1W Fat suppressed image showing high signal intensity adnexal lesions. (B) Axial T2W image showing decreased signal intensity (T2 Shading) indicating chronic hemorrhagic products.
Endometrioma

• Diffusion-weighted imaging with quantitative assessment of apparent diffusion coefficient (ADC) values has been incorporated into pelvic MR imaging protocols.

• The presence of restricted diffusion and low ADC values within an adnexal lesion does not have a high positive predictive value or specificity for the diagnosis of malignancy.

• Endometriomas have low ADC values in part because of “T2 blackout effects”.

Endometrioma

Figure 8: (A) Axial T1-weighed pre-contrast image showing hyper intense hemorrhagic contents. (B) Axial T2-weighted image showing the hypo-intense ‘T2 Shading’; hemorrhagic cysts are brighter on T2-weighted images. (C) Diffusion weighted imaging with value of b500 showing intermediate signal intensity. (D) Diffusion weighted imaging with apparent diffusion coefficient map showing restricted diffusion; restricted diffusion can be variable.
Women with endometriosis are at risk for developing both clear cell and endometrioid subtypes of epithelial ovarian cancer.

An estimated 1-2% of women with endometriosis develop ovarian cancer.

A more specific finding of malignant transformation of an endometrioma is the development of enhancing mural nodules.

Enlargement of the endometrioma with the disappearance of shading on T2-weighted images is suggestive of malignant transformation.

Dynamic subtraction MR imaging is useful for detecting small contrast-enhanced nodules in the hyperintense endometrioma on T1-weighted images.
Figure 10: (A) Coronal reformatted CT showing omental deposits. (B) T1-weighted post-contrast MRI showing a cystic mass in the pelvis with enhancing mural nodule. (C) Photo micrograph showing malignant cells infiltrating the fibro adipose tissue. (D) Microscopy also shows strong positivity for CD10, a marker for endometrial stromal sarcoma (red arrows).
Malignant Transformation

Figure 11: (A) Pre-contrast T1W shows internal hemorrhagic contents. (B) Post-contrast T1W shows enhancing soft tissue components suggesting malignant transformation (endometrioid adenocarcinoma). (C) Axial T2W shows a complex cystic lesion with soft tissue components.
Endometriosis

- There is an increased incidence of endometriosis in patients with Müllerian abnormalities with an obstructed, non-communicating uterine horn.

- Outflow obstruction results in retrograde menstruation and endometriotic implants, often involving both the fallopian tube and the ovary.

- Endometriosis in association with a Müllerian abnormality should be considered in an adolescent patient with chronic pelvic pain.
Müllerian Anomalies and Endometriosis

Figure 12: (A) Coronal (B) sagittal T2W images and (C) axial post contrast T1W image showing Müllerian anomalies including absent vagina and remnant hypoplastic uterus.
Müllerian Anomalies and Endometriosis

Figure 12: (D) Axial pre-contrast fat suppressed T1W in the same patient showing an umbilical nodule with high signal indicating internal hemorrhage. (E, F) Axial fat suppressed pre-contrast images showing hyper intense nodules along the posterior hypoplastic uterus and thickened uterosacral ligaments. (G) Axial CT showing enhancing umbilical nodule.
Conclusions

• Endometriosis is a chronic gynecologic disorder defined by implantation of endometrial glands and stroma outside the uterine cavity causing pelvic pain and infertility.

• The effects of endometriosis may be devastating, and since standard treatment is surgical the radiologist needs to be familiar with the various manifestations in order to aid diagnosis.

• Unusual sites and manifestations of the endometrial implants make the lesions a challenging entity to diagnose.

• Careful scrutiny of the serosa, old scars, and non-gynecologic sites including the bowel, urinary tract, subcutaneous tissue, and even the chest is needed.
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References


Contact

Please email karentran@uky.edu with any questions.

Thank you for viewing our exhibit!