Imaging of Endometrial Carcinoma: A Problem Solving Approach

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Objectives

- How to detect endometrial carcinoma
- Who requires pre-operative staging
- Most accurate modality for staging
- Pearls and pitfalls of staging
- Optimize your MR imaging protocol
Endo Ca Detection

- Most cost-effective method: EUS
- Sensitivity compar. to endometrial biopsy
- Avoids biopsy in >50% of PMB with normal / atrophic endometria

Bindman et al. JAMA 1998; 280: 1510-1517
Endo Ca Detection

- Predefined threshold
  - EUS: > 5mm

- Meta-analysis, 5892 pts.
  - ± HRT
  - > 95% of cancers detected
  - Negative EUS, decreased pretest probability of cancer by 90%

Bindman et al. JAMA 1998; 280: 1510-1517
Endo Ca Detection – No HRT

- **PM bleeding**
  - Pre-test prob: 10%

- **Neg EUS: \( \leq 5 \text{ mm} \)**
  - Post-test prob: 1%

- **Endometrial thickness**
  - Sagittal plane
  - Subtract fluid

ET: 3 mm
Endo Ca Detection – HRT

- PM bleeding
  - Pre-test prob: 1%

- Neg EUS: ≤ 5 mm
  - Post-test prob: 0.1%

- Pos EUS: Many FPs

- Proposed cut-off: > 7 mm
  - Sequential E / P (day 13 – 23)
  - Unopposed estrogen
  - Continuous combined E /P

Lin et al. Radiology 1991; 180: 427-432
Endo Ca Detection – HSG

- ET > 5mm
- DDx. focal from diffuse endometrial thickening
- Triage to hysteroscopy vs endometrial biopsy

ET: 17 mm
Polyp
Endo Ca Detection – MRI

- Problem solving modality
  - EUS technically not possible
  - Indeterminate EUS
  - Biopsy inadequate / unsuccessful
  - Same threshold for ET as EUS
Poor Visualization

Sag TVS

Sag T2 FSE

Endometrial Ca
Pseudo-Widening

Cor EVS

Sag T2 FSE

Endometrial Ca
Imaging Appearance

- Focused on ET
- Imaging appearance nonspec. (EUS / MRI)
- Benign / malignant conditions overlap
- High PPV for Ca: Myometrial invasion

Endometrial Ca

Hyperechoic / Uniform 30%
Imaging Findings - EUS

- Most common pattern
  - Diffuse thickening / mass
  - Destruction of normal endometrium
  - Hyperechoic with hypoechoic areas
  - Flow on colour Doppler

Mixed echogenicity 60%
Imaging Findings - EUS

- Most common pattern
  - Diffuse thickening / mass
  - Destruction of normal endometrium
  - Hyperechoic with hypoechoic areas
  - Flow on colour Doppler

- Cysts seen in 5-15%
  - Cystic area in the Ca
  - Adjacent benign polyp
**Imaging Findings - EUS**

- Beware of the polypoid mass
  - Polypoid cancer
  - Cancer arising from polyp
  - Coexisting polyps
Endometrial Morphology
**Imaging Findings - MRI**

- **T2W (relative to OM)**
  - Hyper 50%
  - Iso 20%
  - Hypo 30%

- **T1W SGE C+**
  - Hypo 75%

- Homogeneous

Histopathology

- 80 - 90% adenocarcinoma
  - Grade 1 to Grade 3
- Adenosquamous carcinoma
- Papillary serous carcinoma
- Clear-cell carcinoma
  - Poor prognosis
  - Clinical behavior

Endometrial carcinoma

Ovarian carcinoma
FIGO Stage I (> 80%)

IA Early IB Late IC

Endometrial Ca

Borrow RC et al. Obstet & Gynecol 1984;63:825-832
Rx. Stratification

- Early stage, low grade
  - Simple hysterectomy
  - 25% understaged / Rx.

- Late stage or high grade
  - Radical hysterectomy
  - Extended LN sampling
  - Adjuvant Rad. Rx.

- MR used to stratify patients

*Ben-Shachar et al. Obstet & Gynecol 2005;105:487-493*
## MRI Evaluation

### PREDICTING DEEP MYOM. INVASION

<table>
<thead>
<tr>
<th>Tumour Grade</th>
<th>Pre-test Prob</th>
<th>MRI Post-test Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>POS</td>
<td>NEG</td>
</tr>
<tr>
<td>1</td>
<td>13%</td>
<td>60%</td>
</tr>
<tr>
<td>2</td>
<td>35%</td>
<td>84%</td>
</tr>
<tr>
<td>3</td>
<td>54%</td>
<td>92%</td>
</tr>
</tbody>
</table>

Pre-Op Staging: Indications

- Depend on local practice patterns
- Grade I/II disease and full surgical staging is not planned
- Advanced disease is suspected
  - Rectal / bladder invasion
- Preoperative Rad. Rx. is planned (IIB)
- Nonsurgical Rx. for low risk disease
## Staging Accuracy: MR vs EUS

<table>
<thead>
<tr>
<th>Stage</th>
<th>MR</th>
<th>EUS</th>
</tr>
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<tbody>
<tr>
<td>Stage IC</td>
<td>82-98</td>
<td>68-99</td>
</tr>
<tr>
<td>Stage II</td>
<td>70-95</td>
<td>30-75</td>
</tr>
<tr>
<td>Stages III-IV</td>
<td>85-95</td>
<td>75-85</td>
</tr>
</tbody>
</table>


Bulky tumor ± hematometra causes OVER staging
Staging Accuracy: MR vs EUS

Co-existing adenomyosis may cause OVER staging.
MRI Criteria – Stage IB

- Abnormal SI confined to inner myometrium
- Irreg. inner myometrium

- Partial or complete disruption of JZ, subend. enhancement

Endometrial Ca
MRI Criteria – Stage IC

- Abnormal signal extends to **outer myometrium**
- Outer myom. stripe intact
- Complete disruption of JZ, subendometrial enhancement
MRI Criteria - Stage IIB

- Disruption of fibrous stroma
- No enhancement of cervical mucosa
Pitfalls of Staging

- Microscopic invasion
- Loss of JZ anatomy
- Poor T-M contrast
- Distention of endometrial cavity
- Adenomyosis
- Benign endometrial / cervical pathology
Microscopic Invasion

Papillary serous
Microscopic Invasion

- T2 FSE
- Substraction post C+

Clear cell
Recurrence

Endometrial Ca
Endometrial vs Cervical Adeno Ca
Uterine Sarcoma

- Most common sarcomas
  - Malignant mixed mullerian tumor (MMMT)
  - Leiomyosarcoma
  - Endometrial stromal sarcoma
- MR findings often nonspecific
- Large, hemorrhagic and necrotic mass
- Myometrial invasion and/or metastatic disease

Rha SE et al. AJR. 2003;1369-1374
Leiomyosarcoma

- Arise de novo
- Malignant degeneration of leiomyoma (< 1%)
- Atypical degenerated leiomyomas
- Clear invasion / metastases
Endometrial Stromal Sarcoma

- Large mass, lobular contour
- No normal endometrium
- Intravascular component
- DDx.
  - Endomet. ca
  - Adenomyosis

“Worm-like” pattern
Endometrial Stromal Sarcoma

“Worm-like” pattern

- Compressed myometrium between bundles of tumour cells
- Low SI bands on T2W

Koyama T et al. AJR 1999;173:767-772
Lymph Node Assessment

- **Criteria:** 1 cm short axis
  - Accuracy 70 – 85%
  - Sensitivity 45 – 60%
  - Specificity 90 – 95%

- MR / CT comparable

- Better techniques
  - USPIO MR
  - Sensitivity 80 – 90%

Courtesy Jelle Barentsz, Netherlands

Rockall et al. JCO 2005;23:2813-2821
MR Imaging Protocol

- Multicoil array (in-FOV SAT bands)
- Antispasmodic
- FOV 20 cm, 3-4mm
- T2W FSE
  - Axial, sagittal,
  - Coronal (short-axis)
  - Matrix 512 x 256
- Axial SGE to renal hilum
  - Lymphadenopathy
MR Imaging Protocol

- Dynamic 2D/3D SGE, F Sat
  - Hypovascular on all phases (75%)
  - **Exception:** Enhances greater than endom. on early arterial phase
  - 2 planes (sag, short-axis)
Summary

- How to detect endometrial carcinoma
  - EUS: 5 mm cut-off
  - Comparable sensitivity to endom. Bx.

- Who requires pre-operative staging
  - Depends on local practice patterns
  - 25% of Grade I/II will have high risk features at final pathology
Summary

- Pearls and pitfalls of staging
  - Beware of histological subtypes that carry a poor prognosis

- Optimize your MR imaging protocol
  - In-FOV SAT bands
  - Short-axis view
  - High-resolution images