Uterine Artery Embolization

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Our Patient: Mrs. L

- 37 year old African American woman presented with complaints of worsening abdominal cramping, dysmenorrhea, menorrhagia, and intermittent constipation
- 5 year history of uterine fibroids
- Gynecologist noted progressive enlargement of a single intramural uterine fibroid; physical exam was remarkable for a tender, 20-week-size uterus w/o pregnancy
- Recent Pap smear and endometrial biopsies WNL
- After a trial of aspirin failed to alleviate her symptoms, Mrs. L consulted IR for potential bilateral Uterine Artery Embolization (UAE) therapy
Uterine Fibroids (*leiomyomas*)

- Benign tumors arising from uterine smooth muscle
- Unknown etiology: hormone dysregulation and genetic factors likely contributory
- High prevalence of asymptomatic patients clouds true incidence; estimates generally range from 20 to 50% of women of child-bearing age, making uterine fibroids the most common solid tumor of the genital tract in women
- Risk factors include a positive family history, nulliparity, and obesity
- Elevated frequency in Afro-Caribbean women
Fibroid Classification by Location

- **Submucosal**: bulge into the endometrial cavity; most often associated with heavy menstrual bleeding and infertility
- **Intramural**: within the muscular wall of the uterus and surrounded by normal uterine tissue; fewest associated symptoms
- **Subserosal**: develop in the serosa; pedunculated subtype may torse and cause pain
Symptoms

- Uterovaginal bleeding
- Menorrhagia and/or refractory anemia
- Feelings of abdominal pressure, discomfort, or pain
- Constipation
- Urinary disturbances
- Dyspareunia
- Lower back pain
Symptoms (cont.)

Symptoms are related to the position, size, and direction of tumor growth:

- Submucosal fibroids may increase the endometrial surface, resulting in a larger bleeding area

- Subserous and intramural tumors may predominantly disturb uterine contractility
Symptoms (cont.)

Symptoms are related to the position, size, and direction of tumor growth:

- Mass effect may contribute to abdominal pain and pressure, urinary disturbances, constipation, and lower back pain.

Example fig 1:
Sagittal T2-weighted MR:
Normal Uterus

Example fig 2:
Sagittal T2-weighted MR:
Pedunculated subserous fibroid compressing adjacent structures

http://www.rad.pulmonary.ubc.ca

Fibroid

Uterus

Uterus
Treatment Options

➤ Medical management
  • Androgens: induce endometrial atrophy
  • Progestins: induce endometrial atrophy
  • Hormone-suppressive therapy (GnRH agonists): hypoestrogenic state causes fibroid shrinkage

➤ Surgery
  • Hysterectomy
  • Myomectomy (open or laproscopic)

➤ Myolysis

➤ MR-guided focused ultrasound

➤ Watchful-waiting (peri-menopausal)
An Alternative:

Uterine Artery Embolization

UAE is a minimally invasive alternative that involves placement of a catheter and injection of an embolizing agent. Its goal is to induce ischemic infarction of the fibroids, while maintaining endometrial and myometrial perfusion.
Uterine Artery Detail

Example figure 3: Uterine artery detail

Digital subtraction angiogram (selective left uterine artery injection)

UAE capitalizes on fibroid vasculature. Typically, the fibroid-supplying arteries branch from the normal uterine arteries. Fibroid vascularization is characterized by increased inflow into numerous irregular intramural vessels and vascular lacunae, very distinct from the low-flow perfusion of the normal myometrium. The increased flow to the fibroids can therefore be used for directed free-flow embolization. For this purpose, it’s typically sufficient to direct the catheter tip into the distal transverse or proximal ascending portion of the uterine artery.

Characteristic UA course (left):

- Initial descending segment \((D)\)
- Transverse segment \((T)\) from which the cervicovaginal artery \((CV)\) originates
- Ascending segment \((A)\)
- Numerous intramural arteries (arrows) are also visible
UAE Indications

- Symptomatic uterine fibroids verified by US or MRI

- Practitioner and patient preference for UAE over other medical or surgical therapies, following detailed discussion of procedural risks, benefits, and alternatives

- Recurrent fibroids post-surgical therapies

- Conditions contra-indicating surgery
UAE Contra-Indications

**Absolute**
- Asymptomatic fibroids
- Infection of UG tract
- Septicemia
- Pregnancy
- Fast growing tumors (suspected malignancy)
- Refusal to undergo hysterectomy following peri- or post- UEA complications

**Relative**
- Pedunculated or very large fibroids extending beyond the umbilicus
- Fibroids with irregular bleeding
- Co-existent adenomyosis
- Desire of future pregnancy
- Mild allergy to contrast medium
Differential Diagnosis

- Pregnancy
- Malignant neoplasm
  - Uterine
  - Ovarian
- Adenomyosis
- Endometriosis
- Cystic mass
- Uterine abscess
Pre-Procedural Imaging: US

- Most common imaging tool
- Fibroids: heterogeneic echogenicity; hypoechoic compared to normal myometrium
- Doppler US specifically assesses fibroid and uterine vascularity and flow patterns
- Exclusion of associated pathological conditions
  - Adenomyosis
  - Adnexal masses
  - Endometrial carcinoma
Pre-Procedural Imaging: **US**

*Mrs. L*

[Sagittal US image showing a fibroid](image)

Fibroid

**Sagittal US**

**PACS, BIDMC**
Pre-Procedural Imaging: *MRI*

- Precise anatomical identification
  - Size
  - Number
  - Uterine tissue layer localization
  - Arterial anatomy

- Prediction of fibroid response to embolization
  - Increased signal intensity on T2-weighted images pre-UAE is usually associated with a considerable reduction in fibroid size post-UAE
Pre-Procedural Imaging: MRI

Mrs. L: T2-weighted MRI

Fibroid

Coronal

PACS, BIDMC
Pre-Procedural Imaging: MRI

Mrs. L: T2-weighted MRI

Fibroid

Sagittal

PACS, BIDMC
Pre-Procedural Imaging: *MRI*

*Mrs. L: T2-weighted MRI*

Axial

*PACS, BIDMC*
Prior to embolization abdominal angiography was performed to obtain an arterial road map that was used to avoid aberrant vessel embolization during the subsequent procedure. Vascular anomalies, additional vaginal or hypogastric arteries, and major anastomoses between uterine and ovarian arteries were not observed. Dilated, tortuous uterine arteries were identified (first branches off the internal iliac arteries).
Angiography: *Vasculature*

*Mrs. L: Flush pelvic aortogram 2*
Angiography: Vasculature

Mrs. L: Flush pelvic aortogram 3

Fibroid
Procedure

- The abdominal aortogram (previous 3 slides) demonstrated a patent, normal infrarenal aorta and patent renal, common, internal and external iliac arteries bilaterally. No obvious antegrade opacification of the uterine arteries was noted.

- A left uterine artery arteriogram was then performed, demonstrating a dilated and tortuous left uterine artery supplying the fibroid. Based on these diagnostic findings, a left UAE was performed using 500-700 micrometer Embospheres, and embolization was continued until there was stagnant flow in the left uterine artery (slides 24-26).

- The micro-catheter was next positioned in the right uterine artery and a similar embolization was performed. Again, embolization was continued until stagnant flow was observed in the right uterine artery (slides 27-30).

- A follow-up abdominal aortogram demonstrated patency of bilateral internal iliac arteries and no further perfusion of the fibroid (slides 31-33).

- Mrs. L tolerated the procedure well and no immediate complications were documented. Moderate sedation was provided throughout the total intraservice time of 3 hours, during which Mrs. L’s hemodynamic parameters were monitored continuously.
Mrs. L: Digital subtraction angiogram: Selective injection of L uterine artery
Left UAE

Mrs. L: Digital subtraction angiogram: Selective injection of L uterine artery

PACS, BIDMC
Left UAE

Mrs. L: Digital subtraction angiogram: Selective injection of L uterine artery

PACS, BIDMC
Right UAE

Mrs. L: Digital subtraction angiogram: Selective injection of R uterine artery
Right UAE

Mrs. L: Digital subtraction angiogram: Selective injection of R uterine artery

PACS, BIDMC
Mrs. L: Digital subtraction angiogram: Selective injection of R uterine artery

PACS, BIDMC
Right UAE

Mrs. L: Digital subtraction angiogram: Selective injection of R uterine artery

PACS, BIDMC
Post-UAE

Mrs. L

PACS, BIDMC
Post-UAE

Mrs. L

PACS, BIDMC
Post-UAE

Pre-UAE  PACS, BIDMC

Lack of fibroid enhancement

Mrs. L  PACS, BIDMC
Clinical Outcome

Mrs. L was the most recent patient to receive UAE at our hospital. Thus, her longer-term clinical outcome can not yet be assessed. However, we might expect her fibroids to first show infarction and then, to begin shrinking in size. MRI can accurately demonstrate tumor infarction just 24 hrs post-UAE. The companion patient below well exemplifies this.

*Companion Patient 1:*
Sagittal T2-weighted MRI: pre-UAE

*Companion Patient 1:*
Sagittal T2-weighted MRI: 24 hr post-UAE

F: Fibroid

*Felage et al, 2005.*
Mrs. L was the most recent patient to receive UAE at our hospital. Thus, her longer-term clinical outcome can not yet be assessed. However, we might expect her fibroids to shrink significantly in size by 6 months post-UAE, as exemplified by this companion patient (right).
Six Months Post-UAE

Companion Patient 2


Coronal T2 MRI: pre-UAE

Coronal T2 MRI: 6 months post-UAE

★ Urinary bladder
Six Months Post-UAE

Companion Patient 2

Axial T2 MRI: pre-UAE

- Urinary bladder

Axial T2 MRI: 6 months post-UAE
Clinical Outcome

- Procedure shows high technical success rate, ranging between 81 and 91%
- Symptoms of menorrhagia, dysmenorrhea, pelvic pressure, and/or urinary urgency are controlled in 73-97% of patients
- Reduction in fibroid size: 42-83%
- Reduction in uterine size: 43-58%
- > 90% patients are satisfied with procedure and report a significantly improved quality of life
- Preserved fertility
- Shorter recovery time than surgery
Potential Complications

- Angiography Complications
  - Haematoma in the pelvis
  - Contrast medium reaction
  - Dissection of internal iliac or uterine artery
  - Rupture of vesicle artery branch

- Post-embolization syndrome \(\Rightarrow\) prolonged hospitalization

- Pelvic Infection

- Ischemic phenomena
  - Severe, prolonged pelvic pain
  - Transient or permanent amenorrhea
  - Sexual dysfunction related to nontarget embolization (cervicovaginal branch)
  - Embolization of nontarget organs (bowel, bladder, buttock, nerves)

- Adverse drug reaction

- Pulmonary embolism
Treatment Comparison

<table>
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<th>Event</th>
<th>Hysterectomy</th>
<th>Myomectomy</th>
<th>UAE</th>
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<tr>
<td>Overall morbidity</td>
<td>40%</td>
<td>39%</td>
<td>5%</td>
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<tr>
<td>Febrile morbidity</td>
<td>26%</td>
<td>33%</td>
<td>2%</td>
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<tr>
<td>Readmission</td>
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<td>4.5%</td>
<td>2.5%</td>
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<tr>
<td>Life-threatening event</td>
<td>1.0%</td>
<td>1.5%</td>
<td>0.5%</td>
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Sawin et al. 2000.
Conclusions

- Uterine fibroids are a common condition in women and often cause symptoms that negatively impact quality of life.
- UAE is a safe, well-tolerated, and an effective alternative treatment for symptomatic uterine fibroids.
- UAE is a reasonable option for women who wish to preserve their uterus and avoid surgery and a prolonged recovery period.
- UAE has low complication rates with excellent clinical outcomes and high patient satisfaction rates.
Future Considerations

- Continued effort to reduce radiation exposure
- Effect on pregnancy
- Long-term effect of embolic agents
- Recurrence rate reduction
References

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