Uterine Artery Embolization (UAE) vs Laparoscopy vs HIFU

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Disclosure

Speaker name: Thomas Vogl

I have the following potential conflicts of interest to report:

- Consulting
- Employment in industry
- Stockholder of a healthcare company
- Owner of a healthcare company
- Other: travel grant

- I do not have any potential conflict of interest
Uterine Myoma: Treatment Options

- Symptomatic treatment of irregular bleeding:
  - gestagen, oestrogen-gestagen combinations
  - endometrial ablation
  - Mirena
  - Esmya

- Hysterecomy

- Surgery:
  - hysteroscopy, laparoscopy, laparotomy

- Uterine artery embolization

- Focused ultrasound:
  - MR guided HIFU, US guided HAIFU
UAE: Consent and Preinterventional Counseling

- Co-operation with the gynecologist is important
- Explain the procedure
- Discuss the issue of pregnancy fully
- Discuss post-interventional pain
- Answer patient’s questions

Remember you are dealing with a benign disease in young women
Uterine Artery Origin

Common iliac artery

Int. iliac artery
- Ant. division: 0.6%
- Post. division: 85.5%

Ext. iliac artery
- Ant. division: 4.2%
- Post. division: 7.9%

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Angle Prediction and Effect on Radiation Exposure

Naguib, Vogl et al, Radiology 2009; 251(3):788-795

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Usage of the Cephalo-caudal Angulation
Angle Prediction and Effect on Radiation Exposure

Naguib et al, Radiology 2009; 251(3):788-795

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Embolization Material Selection

Size: 500-700 µm or 700-900 µm
Rarely: 350-500 µm
>300 µm obsolete

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## Embolization Material Selection

### Pros

**Polyvinyl Alcohol Bead-Block**
1. Nonresorbable (~Permanent)
2. Precisely calibrated
3. FDA approved for UAE
4. 1st Embolizing material used by Ravina (conventional)

**Tris-Acryl Gelatin Microspheres Embosphere**
1. Nonresorbable (~Permanent)
2. Precisely calibrated
3. 1st FDA approved embolizing material for UAE
4. More deformable and less tendency to aggregate

**Gelatin sponge Gelfoam**
1. Not expensive
2. Absorbable within 21 days (Recanalization after 4 months)<sup>1</sup>
3. Future pregnancy

### Cons

1. Expensive
2. Permanent

1. Expensive
2. Permanent

1. Absorbable ? symptom recurrence
2. Not calibrated

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*Barth et al, Invest Radiol 1977; 12:273-280*

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Prediction of the Predominant Side of Supply

The resistive index can predict the correct side of predominant supply in 81.6% of cases.


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## Effect of Location of Leiomyoma on the Outcome

<table>
<thead>
<tr>
<th>Location</th>
<th>Volume before UAE (cm³)</th>
<th>Volume 3 mo after UAE (cm³)</th>
<th>Decrease (%)</th>
<th>Volume 1 y after UAE (cm³)</th>
<th>Decrease (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Submucous (n = 7)</td>
<td>14.71 ± 15.63</td>
<td>3.56 ± 5.73</td>
<td>71.1 ± 24.18</td>
<td>2.04 ± 4.92</td>
<td>87.43 ± 23.45</td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>2.52–45.75</td>
<td>0.54–16.45</td>
<td>24.6–96.7</td>
<td>0–13.16</td>
<td>39.6–100</td>
</tr>
<tr>
<td>Range</td>
<td>0.72–339.59</td>
<td>0.27–270.19</td>
<td>14.3–83.6</td>
<td>0.04–337.1</td>
<td>0.7–98.4</td>
</tr>
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<td>Interstitial (n = 28)</td>
<td>59.98 ± 89.21</td>
<td>31.61 ± 57.38</td>
<td>54.68 ± 19.92</td>
<td>23.97 ± 64.62</td>
<td>73.54 ± 24.62</td>
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<td>Subserous (n = 49)</td>
<td>52.08 ± 78.28</td>
<td>32.42 ± 52.17</td>
<td>47.33 ± 23.41</td>
<td>27.3 ± 52.88</td>
<td>59.21 ± 40.52</td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>0.95–371.1</td>
<td>0.26–224.82</td>
<td>-19.8 to 95.4</td>
<td>0.03–271.06</td>
<td>-98.2 to 99</td>
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</tbody>
</table>

Note.—negative values indicate volume increase.
Embolization Material Selection

Polyvinyl Alcohol versus Microspheres:
- Similar outcome for both types \(^1,\!^2\)
- Better clinical outcome and devascularization for Microspheres than polyvinyl alcohol\(^3,\!^4\)

Gelfoam versus Polyvinyl alcohol:
- Gelatin sponge particles alone is a safe and effective treatment for symptomatic leiomyomas and that the outcomes bear comparison with PVA \(^5\)
- Gelatin sponge particles over PVA in terms of improvement of mean bleeding score and volume reduction rate of dominant fibroid after three months \(^6\)

5. Katsumori et al. AJR  2002;178:135–139

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Catheters

**Right side:**
- Cobra 5F with modified Waltman loop
- Sidewinder 5F
- Sidewinder 5F with Microcatheter

**Left side:**
- Cobra 4F or 5F


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MRI Immediately After UAE

Patterns of enhancement

Prognosis

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MRI Immediately After UAE

Endometrial-myometrial Ischemia

Centrally located irregular area of endometrial and myometrial ischemia

Revascularization of the ischemic area at three month follow-up
UAE: Take Home Points

1. You are dealing with a benign tumor in young age
2. MRI before UAE will help select patients
3. Add MRA to detect anatomy and reduce radiation exposure
4. +/- Doppler to predict predominant side of supply
5. Do not forget the cephalo-caudal angulation option
6. Do not use a size below 300 μm
7. Embosphere > PVA, Gelfoam
8. Use the catheter you can master
9. +/- MRI immediately after UAE for enhancement pattern
10. First follow-up MRI not before 3 months
Patient Selection for HIFU

1. Patients with symptomatic uterine leiomyoma not responding to medical treatment
2. Clear acoustic pathway of leiomyoma
3. Patient compliance
4. Signal intensity on T2 weighted MRI
5. Contraindications include: pregnancy, pelvic malignancy or active inflammatory process, extensive scarring or surgical clips

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HIFU: Patient Selection
Factors Affecting Treatment

- **Factors increasing ablation difficulty:**
  1. Retroverted uterus
  2. Posterior location of tumor
  3. Intramural leiomyoma

- **Factors influencing the amount of energy required:**
  1. Leiomyoma size (large need less energy)
  2. T2 signal intensity
  3. Enhancement (progressive enhancement need more)
  4. Acoustic pathway

*Peng et al, Medicine (Baltimore) 2015 Apr; 94(13):e650*

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HIFU: Results

7,439 Patients treated in 10 centres in China between 2006 and 2013:

- The average treatment time was 84.2±38.8 min (range 30–240 min)
- The sonication time was 1243.8±725.2 (range 506–2658) s
- The technical success rate was 98.4% (7319/7439)
- The NPV ratio was 83.1±15.6% (range 25–100%)
- The re-intervention rate was less than 10% after 24-month follow-up

## HIFU: Results

### Table 3. Symptom Improvement After Sonographically Guided High-Intensity Focused Ultrasound Therapy

<table>
<thead>
<tr>
<th>Article</th>
<th>Before Treatment</th>
<th>1</th>
<th>3</th>
<th>6</th>
<th>12</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>1⁹</td>
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<td>5⁸</td>
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<tr>
<td>6¹⁶</td>
<td></td>
<td>38.1ᵃ</td>
<td>48.2ᵃ</td>
<td>50.0ᵃ</td>
<td>66.7ᵃ</td>
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<tr>
<td>1⁹</td>
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<td></td>
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</tr>
<tr>
<td>3¹⁴</td>
<td></td>
<td></td>
<td></td>
<td>92.0ᶜ</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| 12      | 16ᵇ             |       |       |       |       |       |
| 12      | 13.3ᵇ           |       |       |       |       |       |
| 12      | 11ᵇ             |       |       |       |       |       |

ᵃPercentage of patients who showed improvement.
ᵇUterine Fibroid Symptom and Quality of Life score.
ᶜPercentage of patients who reported a reduction in their Uterine Fibroid Symptom and Quality of Life score.

*Cheung et al, J Ultrasound Med 2013; 32:1353–1358*

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**HIFU: Results**

46-year-old patient – Goethe University FFM

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HIFU: Conclusions

- HIFU should be considered as one of the treatment options for patients with symptomatic uterine leiomyoma not responding to medical treatment.
- Careful selection of the patient is important to ensure safe and effective treatment.
- The issue of pregnancy should be thoroughly discussed with patients who haven’t completed their family plans.
Review of nonsurgical/minimally invasive treatments and open myomectomy for uterine fibroids

- MRgFUS is a cost-effective nonsurgical alternative, especially in eligible older women and those with hypointense fibroids on T2 weighted.

- UAE is advocated as a minimally invasive uterine sparing option for symptomatic fibroids but should be offered with caution in women who wish to retain fertility because of less favourable reproductive outcomes.

- Radiofrequency ablation/myolysis is an emerging conservative option and the transvaginal route seems to be a promising approach as it can be offered as outpatient procedure without the risk of general anaesthesia.

- Laparoscopic myomectomy results in less postoperative pain, reduced febrile morbidity, and shorter hospital stay compared with laparotomy.

- The newer robotic-assisted laparoscopic myomectomy is comparable with traditional laparoscopic approach in terms of short-term surgical outcomes but is expensive.
FISI 2019

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Computertomographie

Frankfurt/Main, 15 – 16. November 2019

www.fisi-frankfurt.de
HIFU: Results

Before HIFU
44-year-old patient – Goethe University FFM

After HIFU

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HIFU and Pregnancy

24 out of 435 patients had unintended pregnancies within 1 year after HIFU

- 8 desired pregnancies
  - 7 reached full-term - no complications

- 14 undesired pregnancies
  - One abortion
  - 14 elective abortions

- 2 spontaneous abortions

CONCLUSION:
For a woman with symptomatic fibroids who wishes to retain her uterus, apart from medical treatment, various nonsurgical and minimally invasive conservative surgical options are available. Among the nonsurgical options, UAE and, in eligible patients, MRgFUS are more established with availability of larger data and comparative efficacy. Minimally invasive surgeries (laparoscopic and robotic approach) have definite advantage over open myomectomy in terms of less postoperative pain and faster recovery. A transvaginal approach for radiofrequency ablation as an outpatient procedure seems to be a promising new nonsurgical alternative although it requires more evidence before it can be accepted in day-to-day practice.


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Effect of Location of Leiomyoma on the Outcome
MR Angiography Before Uterine Artery Embolization
HIFU: Results

Follow-up after 3 months

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Usage of the Cephalo-caudal Angulation

- An additional cephalo-caudal angulation was required in 15% of patients for the right side.

- An additional cephalo-caudal angulation was required in 30% of patients for the left side.
1. Exclude contraindications
2. Set baseline
3. Select your patients (avoid leiomyomas $\geq 12$ cm, multiplicity is not bad)
Prediction of the Predominant Side of Supply

Left Uterine Artery RI = 0.64

Right Uterine Artery RI = 0.72

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Prediction of the Predominant Side of Supply

Failed to embolize one side

- Predominant side
  - Contralateral puncture
  - Second intervention

- Non-predominant side
  - Wait and see
  - Second intervention
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Uterine Artery Embolization (UAE) vs Laparoscopy vs HIFU

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