WOMEN’S HEALTH IN INTERVENTIONAL RADIOLOGY

Danny Chan, MD
Assistant Professor
UT-Southwestern, Dallas Texas
No financial disclosures
What is Interventional Radiology (IR)?

A specialty that developed from Diagnostic Radiology where Radiologists use Imaging Techniques to guide catheter-based procedures and patient care.
“Interventional radiologists are board-certified physicians who specialize in minimally invasive, targeted treatments. They offer the most in-depth knowledge of the least invasive treatments available coupled with diagnostic and clinical experience across all specialties”
Interventional Radiologists: Who are we? What do we do?

- 1st Minimally Invasive Clinicians
- Pioneers in...
  - Angiography
  - Angioplasty
  - Stenting
  - Embolotherapy
  - Many other catheter based therapies
Percutaneous Catheterization

- 1st: Puncture vessel
- Then insert **guidewire** thru needle
- Next remove needle
- Thread **catheter** over wire and advance to desired location
- Remove wire and **inject** through catheter
Diagnostic Catheters

1.7mm diameter
Catheterization
Fluoroscopy & Angiography

- Fluoroscopy ("Fluoro")
  Movie-like Real-time X-ray images

- Angiogram ("Angio")
  Sequential images during contrast injection through catheter

- Digital Subtraction Angiogram ("DSA")
  Subtracts out all tissues and leaves only the contrast visible
Women’s Health and IR

- Uterine Fibroids
- Pelvic Congestion Syndrome
- Varicose vein treatment
Uterus gone wild: Fibroids

- Heavy bleeding +/- anemia
- Severe menstrual cramping
- Mass Effect
  - Fullness
  - Compression of bladder
  - Compression of rectum
Symptoms

- The most frequent symptom is menorrhagia.
- Dysmenorrhea, pelvic pain and pressure, dyspareunia, urinary frequency and urgency, and other pelvic symptoms may occur.
Uterine Leiomyoma Etiology

Etiology is poorly understood

- Evidence points to the monoclonal development of fibroids
  - Identical glucose-6-phosphate dehydrogenase iso-enzyme activity in cells from the same tumor\(^3\)
  - PCR demonstrated similar X-linked inactivation patterns of the phosphoglycerol-kinase gene\(^4\)

- Epidemiological studies suggest genetic component
  - Familial clustering
  - Cross-sectional studies in Caucasian populations demonstrate odds ratio of 2.2-4 for female relatives\(^5\)
  - Twin studies show increased risk of fibroids in monozygotic twins compared to dizygotic\(^5\)
  - Specific genes have yet to be identified

- Estrogen, progesterone, growth factors play important role in stimulating growth
Prevalence

- The overall incidence has been reported to be 29.7 per 1000 patient years,
- Peak incidence women who are in their early to mid-40s.
- Risk higher by a factor of three among blacks than among whites
Hysterectomy: The Only Treatment?

www.hystersisters.com
Management

- **Hysterectomy**: The most definitive treatment but also the most invasive. Impairs future fertility.

- **Myomectomy**: Surgical option that preserves future fertility but is more complicated procedure than hysterectomy, involving longer recovery, greater risk of blood transfusion and infection.

- **Oral Contraceptive Pills**: Although OCPs will not shrink fibroids, they may provide symptomatic relief especially in relation to menstrual bleeding.

- **GnRH Agonists**: Through suppression of the release of gonadotropins, this treatment effectively reduce estrogen levels and thereby fibroid size. However, fibroids rapidly re-grow once treatment is stopped. May be useful to reduce the size of large fibroids prior to surgery.

- **Embolization**: Newest treatment that is less invasive than surgery but also has higher failure rate.
UTERINE FIBROID EMBOLIZATION (UFE)

- Minimally invasive
- Uterine sparing
- Effect on all fibroids
- Low incidence of complications
PATIENT EVALUATION

History and physical
- Menstrual history
- Fibroid related symptoms
- Pelvic exam
- PAP smear results
- Endometrial biopsy results
- Imaging results

ALL WOMEN STILL NEED A GYNECOLOGIST!
PATIENT SELECTION

- Non-pedunculated fibroids
- Minimal adenomyosis
- No endometrial lesions
- Uterus with some normal myometrium
- Location and degree of submucosal involvement
- Enhancement of fibroid
IMAGING

- Location of fibroids
- Pedunculated fibroids
- Fibroid vs adenomyosis
- Size of fibroids
- Vascularity of fibroid
- Other pathology
Inexpensive

Readily available

May not distinguish diffuse fibroid disease from adenomyosis or other conditions.

Sometimes poor at defining location of fibroids
MRI: Pre-UFE Necessity

- Most accurate modality for detection and localization of fibroids
- Diagnose and quantify adenomyosis
- Diagnosis of endometriosis
- Consistent size measurements
- Assess viability/flow to uterus/fibroids

ADENOMYOSIS

Endometrial Cancer

Courtesy of Howard Chrisman, M.D.
Large Pedunculated Serosal Fibroid
Fibroids!
PROCEDURE

- 23 hours admission
- Pre-op holding
  - NPO
  - IV fluids
  - Prophylactic antibiotics
  - Anti-inflammatory
    - Ketorlac
    - Cox-2 inhibitor
PROCEDURE

- Angio suite
  - Conscious sedation
    - Anxiolytic
      - Versed
    - Analgesics
      - Fentanyl
  - Foley catheter
Accessing the Uterine Artery

- Catheter
- Femoral artery
- Fibroid
- Uterine artery
EMBOLIZATION MATERIALS

- Polyvinyl alcohol particles
- Embolization spheres
  - PVA (Contour, Boston Scientific)
  - Tris-acryl collagen coated microspheres (Embospheres, Biosphere Medical)
- Gelfoam (Pharmacia and Upjohn Company)
Duration and Severity of Post-UFE Recovery

- Peak in-hospital VAS score of 3.03
- Mean peak outpt VAS score of 4.89
- 93.8% missed < 10 days work
  - 45.7% missed < 7 days work
- Fever in one third of pts
  - most freq on day 3
- Cramping, general fatigue
  - Resolves within a few days

FIRST WEEK

- Mild to moderate cramping
  - Analgesic (usually containing an antipyretic)
  - Anti-inflammatory
    - Cox-2 or NSAID

- Nausea (rare post discharge)
  - Antiemetic
    - Oral
    - suppository
SECOND WEEK

- Most return to normal activities
- Anti-inflammatory
  - Ibuprofen
- Vaginal discharge/spotting
FOLLOW-UP

- Frequent telephone follow-up in 1st week
- Office visit for questions/problems

Menstrual cycle
- Ovarian failure in 2 – 15%
  - Depends on age
  - Up to 3 months to determine new cycle

- Office visit 3 months
- MRI at 6 months
Adverse Effects

- In a single-center study of 400 consecutive patients, the event rate for major complications was 4.3% during the first year.
- Most common constellation of symptoms during recovery is post embolization syndrome,
- Consists of pelvic pain, fever, and malaise.
- The syndrome can usually be managed with analgesics and antipyretic agents, although more severe symptoms may require prolonged hospitalization or rehospitalization.
- It is important to distinguish this syndrome from infection.
- No deaths have been reported in any of the large clinical studies.
POST EMBOLIZATION SYNDROME

- Pain
- Nausea/Vomiting
- Fever
- Leukocytosis
- Malaise
## Complications of UFE

<table>
<thead>
<tr>
<th>Complication</th>
<th>n (percentage of study experiencing complication)*</th>
<th>In-hospital</th>
<th>Postdischarge to 30 d</th>
<th>31–90 d</th>
<th>91 d–1 y</th>
<th>&gt;1 y</th>
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<tbody>
<tr>
<td>None</td>
<td>358 (90)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Allergic reaction/rash</td>
<td>10 (2.5)</td>
<td>1</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Leiomyoma passage</td>
<td>10 (2.5)</td>
<td>0</td>
<td>3</td>
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<tr>
<td>Recurrent/prolonged pain</td>
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<td>5</td>
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<tr>
<td>Urinary tract infection</td>
<td>4 (1)</td>
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<td>4</td>
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<tr>
<td>Endometritis</td>
<td>2 (0.5)</td>
<td>0</td>
<td>0</td>
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<td>1</td>
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<td>Femoral nerve injury</td>
<td>3 (0.75)</td>
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<td>Vessel injury</td>
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<td>Urinary retention</td>
<td>2 (0.5)</td>
<td>1</td>
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<td>Vaginal discharge</td>
<td>1 (0.25)</td>
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<td>0</td>
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<tr>
<td>Hematoma</td>
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<tr>
<td>Deep venous thrombosis</td>
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<td>0</td>
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<td>Drug reaction</td>
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<td>Thrush</td>
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<td><em>Clostridium difficile</em> difficile infection</td>
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<td>1</td>
<td>0</td>
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<tr>
<td>Pulmonary embolism</td>
<td>1 (0.25)</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Total</td>
<td>47</td>
<td>10</td>
<td>27</td>
<td>4</td>
<td>5</td>
<td>1</td>
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</table>

*Forty-seven complications occurred in 42 patients.*

UFE Complications-Summary

- Fibroid expulsion 3-7%
- Vaginal discharge 0-5%
- Endometritis/Infection 0-3%
- Ovarian failure
  - < 45 yrs old 1 – 2%
  - > 45 yrs old 14 - 15%
- Contrast, medication allergies 1%
- Groin site complications 1%
Early UFE Failures

- Unilateral uterine artery embolization
- Severe arterial spasm
- Ovarian artery supply to fibroids
- Incorrect clinical indications
  - Adenomyosis
OVARIAN COLLATERALS TO FIBROID

Ovarian artery

Courtesy Anne Roberts, MD
Premature Menopause due to UFE

- < 45 yrs old: 1 – 2%
- > 45 yrs old: 10 - 15%

Infertility and Premature Menopause may be two faces of non-target ovarian damage.
1st Report of UFE

- 16 patients (34-48 yrs)
- 100% technical success
- 20 month follow-up
  - 11 complete response
  - 3 partial improvement
  - 2 failures

Ravina et al. Arterial embolization to treat uterine myomata. 
*Lancet* 346[8976]:671-672, 1995
Randomized Trials

REST Trial* Myomectomy vs UFE

Short-term Results

- UFE less painful at 24 hours (VAS of 3.0 vs 4.6, P < .001).

- UFE shorter stay (1 vs. 5 days, P < .001).

- Return to work (20 vs 62 days, P < .001).

- No difference in adverse events:
  - Major events (15% UFE vs 20% surgery, P = .22).
  - Minor events (34 UFE vs 20% surgery, P = 0.47).

Surgery has significantly lower quality of life at 1 month after the procedure. However, at one year after the procedure, the quality of life is comparable between surgery and UAE.

UAE was associated with a lower use of resources at the initial hospitalization but required more imaging studies and follow-up after one year.

Overall, UAE is more cost effective with the mean savings of $951.
# Clinical Results of UFE

<table>
<thead>
<tr>
<th>Patients</th>
<th>Bleeding</th>
<th>Pain/Bulk</th>
<th>Cx(%)</th>
<th>F/U</th>
<th>Comment</th>
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<td>Pron, 03</td>
<td>538</td>
<td>83%</td>
<td>82%</td>
<td>2</td>
<td>8 m</td>
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<td>Spies, 02</td>
<td>400</td>
<td>N/A</td>
<td>N/A</td>
<td>9</td>
<td>30 d 1 sarc</td>
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<td>Walker, 02</td>
<td>400</td>
<td>84%</td>
<td>79%</td>
<td>13</td>
<td>17 m</td>
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<tr>
<td>Spies, 01 200</td>
<td>90%</td>
<td>91%</td>
<td>0.5</td>
<td>21</td>
<td>m</td>
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<td>McLucas, 01</td>
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<td>70%</td>
<td>11</td>
<td>12 m 4 unilat</td>
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<td>Pelage, 02</td>
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<td>90%</td>
<td>N/A</td>
<td>5</td>
<td>24 m 4 unilat</td>
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<td>Brunereau, 00</td>
<td>58</td>
<td>97%</td>
<td>N/A</td>
<td>2</td>
<td>24 m</td>
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<tr>
<td>Spies, 99 61</td>
<td>89%</td>
<td>96/,%</td>
<td>5</td>
<td>9</td>
<td>m</td>
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<tr>
<td>Goodwin, 99</td>
<td>60</td>
<td>91%</td>
<td>91%</td>
<td>4</td>
<td>16 m 2 endomet</td>
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<tr>
<td>Worthington</td>
<td>53</td>
<td>88%</td>
<td>94%</td>
<td>0</td>
<td>3 m</td>
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<tr>
<td>Goodwin, 97</td>
<td>11</td>
<td>85%</td>
<td>88%</td>
<td>1</td>
<td>6 m 1 endomet</td>
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<tr>
<td>Ravina, 95</td>
<td>16</td>
<td>68%</td>
<td>N/A</td>
<td>0</td>
<td>20 m</td>
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</table>
UFE Efficacy-Summary

- Menorrhagia 87-95%
- Pelvic pain/dysmenorrhea 85-97%
- Bulk-related Symptoms 80-94%
- Reduction in Fibroid Volume 40-65%
  ■ (3 months)
Pregnancy and Fertility

- Research ongoing but still reserved for patients who have failed surgical options
- Age related risk of ovarian failure 2 – 15%
- Successful pregnancies after UFE reported
- Higher risk (50 cases)
  - Malpresentation
  - Preterm birth
  - Cesarean delivery
  - Post-partum hemorrhage

Impaired fertility after UFE?

1. Residual fibroid mass effect
2. Embolic change in myometrium
3. “Collateral” ovarian damage
   Ischemia
   Hormonal changes

Razavi et al. Radiology 2002; 224:707-712
DURABILITY

UFE pts more likely than myomectomy pts to require further invasive treatments (29 vs 3%)

Broder et al, Obstet Gynecol 2002;100:864-868
Randomized Studies
Myomectomy vs UFE: Prague Trial*

- Mid-term results
  - 121 patients randomized UFE vs Myomectomy
    - Myomectomies: 63
    - UFE: 58
  - Follow-up: 118 pts - Minimum 12 months, mean 24.9 months

- Most clinical outcomes no difference

- UFE higher re-intervention, (36% vs 6.1%, p=0.01)
  - Re-intervention routine on UAE if persisting fibroid > 5cm, or recurrent fibroid in UFE or myomectomy > 5 cm.

200 treated
182 (91%) followed-up
Failures (N = 36) → 20%
SXS not improved (N = 9) → 5%
Doing well (N = 132) → 73%

Spies J et al. CIRSE 2005 (Abstr)
Re-intervention

- Technically inadequate UFE procedure
  - Not enough particles
  - Collaterals that supply fibroids NOT recognized or treated
- Symptoms not due to fibroids (co-existent)
  - Adenomyosis
  - Endometriosis
  - Pelvic congestion, non-gyn pelvic pain
- Regrowth of fibroids
Summary

- UFE is safe and effective
- Cost effective
- Reasonably durable
SUMMARY

Promises Unmet:

- Not all women qualify
- Many qualified women are not being referred
- Myomectomy may be preferred for
  - Women who desire fertility
  - Young patients
Pelvic Congestion Syndrome – Chronic Pelvic Pain in Women

- It is estimated that one-third of all women will experience chronic pelvic pain in their lifetime.
- Many of these women are told the problem is "all in their head" but recent advancements now show the pain may be due to hard to detect varicose veins in the pelvis, known as pelvic congestion syndrome.
Etiology

- Associated with the presence of ovarian and pelvic varicose veins.
- Valves in the veins that help return blood to the heart against gravity become weakened and don't close properly.
- Allows blood to flow backwards and pool in the vein causing pressure and bulging veins.
- In the pelvis, varicose veins can cause pain and affect the uterus, ovaries and vulva.
Prevalence

- Women with pelvic congestion syndrome are typically less than 45 years old and in their child bearing years.
- Ovarian veins increase in size related to previous pregnancies.
- Pelvic congestion syndrome is unusual in women who have not been pregnant.
- Studies show 30% of patients with chronic pelvic pain have pelvic congestion syndrome (PCS) as a sole cause of their pain and an additional 15% have PCS along with another pelvic pathology.
Diagnostic Dilemma

- The diagnosis is often missed because women lie down for a pelvic exam, relieving pressure from the ovarian veins, so that the veins no longer bulge with blood as they do while a woman is standing.

- Many women with pelvic congestion syndrome, spend many years trying to get an answer to why they have this chronic pelvic pain.
Risk Factors

- 2 or more pregnancies
- Retroverted uterus
- Having fullness of the leg veins
- Polycystic ovaries
- Hormonal increases or dysfunction.
Diagnosis and Assessment

- **Pelvic venography**: Injecting contrast dye in the veins of the pelvic organs to make them visible during an fluoroscopy.
- **MR Venography**
- **CT Venography**
- **Ultrasound**: Ultrasound may be used to exclude other problems that might be causing pelvic pain.
Pelvic Ultrasound
MRV
Pelvic Venogram with Treatment
Treatment Options

- Embolization
- Analgesics
- Hormones such as birth control pills decrease a woman's hormone level causing menstruation to stop, which may be helpful in controlling her symptoms.
- Surgical options include a hysterectomy with removal of ovaries, and tying off or removing the veins.
Procedure

- Outpatient procedure
- Right neck or groin venous access
- Venogram to look for dilated gonadal veins
- Coil embolization
- Additional embolic agents (alcohol, glue, glucose)
Efficacy

- Less expensive to surgery and much less invasive, embolization offers a safe, effective, minimally invasive treatment option that restores patients to normal.
- The procedure is very commonly successful in blocking the abnormal blood flow.
- It is successfully performed in 95-100 percent of cases.
- A large percentage of women have improvement in their symptoms, between 85-95 percent of women are improved after the procedure.
- Although women are usually improved, the veins are never normal and in some cases other pelvic veins are also affected which may require further treatment.
Summary: Pelvic Congestion Syndrome

- Diagnosis of exclusion
- Imaging and history key
- Embolization, safe and effective
Treatment of Lower Extremity Venous Insufficiency

- Varicose veins
- Spider veins
- Reticular veins
Prevalence

- 25% of women and 15% of men suffer from venous insufficiency
- Chronic venous insufficiency can lead to varicose veins
- Most commonly seen in the GSV, SSV, and other truncal veins of the superficial venous system
Prevalence of Venous Disease

Varicose Veins
20+ million

Swollen Leg
6 million

Skin Changes
1 million

Skin Ulcer
500,000
ETIOLOGY

- Heredity
- Advancing age
- Prolonged standing
- Being overweight
- Hormonal influences during pregnancy
- Birth control pills
- Post-menopausal hormonal replacement therapy
- Prolonged sitting with legs crossed
- Wearing tight undergarments or clothes
- A history of blood clots
- Injury to the veins
- Conditions that cause increased pressure in the abdomen including liver disease, fluid in the abdomen, previous groin surgery, or heart failure
Min et al, JVIR
14:1233-41, 2003
SYMPTOMS

- Leg heaviness and aching
- Hyperpigmentation
- Pain
- Restlessness
- Induration
- Ulceration
- Lipodermatosclerosis
Skin Changes from Venous Disease

- Pigmentation
- Venous eczema
- Lipodermatosclerosis
Treatments

- Ligation and Stripping
- Sclerotherapy
- Photoderm
- Endovenous laser therapy
Ligation & Stripping

- Ligation and division of the saphenous trunk and all proximal tributaries is followed by stripping or by avulsion phlebectomy.
- Proximal ligation requires a substantial incision at the groin crease.
- Stripping of the vein requires additional incisions at the knee or below the knee and is associated with a high incidence of minor surgical complications.
- Avulsion phlebectomy requires multiple 2- to 3-mm incisions along the course of the vein and can cause damage to adjacent nerves and lymphatic vessels.
Sclerotherapy

- Injection of a solution (generally sodium chloride) directly into the vein.
- The solution irritates the lining of the vessel, causing it to swell and stick together.
- Over time, the vessel turns into scar tissue that fades from view.
- The procedure is simple, relatively inexpensive, and can be performed in an outpatient setting.
Photoderm

- Intense, pulsed light can be used to selectively damage or destroy abnormal veins including small spider veins, certain sizes of varicose veins and vascular birthmarks.
- This treatment may be recommended when sclerotherapy or laser therapy does not effectively treat the vein.
- One to six treatments may be required to properly treat the area.
ENDOVASCULAR LASER THERAPY

- Thermal destruction of the venous tissues.
- Laser energy (most commonly from an 810-nm diode laser) is delivered to the desired location inside the vein through a bare laser fiber that has been passed through a sheath to the desired location.
- Deposits thermal energy in the blood and venous tissues, causing irreversible localized venous tissue damage.
- The laser is repeatedly or continuously fired as the laser fiber is gradually withdrawn along the course of the vein until the entire vessel is treated.
Vein Ablation

Superficial Veins of the Leg

Catheter in Vein

Great Saphenous Vein

Vein Heated

Catheter entry point

Varicose Vein

Vein Closes

Laser Fiber

Greater Saphenous Vein
DELTA LASER

- Fiber Recognition System
- MultiMedia Card (MMC) and Drive
- Solid-State Diode Technology
- 3 Color Coded lengths
- 25cm, 55cm, and 80cm
- Ergonomic hub
1 week after EVLT® only
## EVLT VS. SURGERY

<table>
<thead>
<tr>
<th></th>
<th>OFFICE</th>
<th>HOSPITAL</th>
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<tbody>
<tr>
<td>Local</td>
<td>93-98% SUCCESS</td>
<td>77-82% SUCCESS</td>
</tr>
<tr>
<td>Recovery</td>
<td>1-2 DAYS</td>
<td>3-4 DAYS</td>
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<tr>
<td>Complications</td>
<td>0.3%</td>
<td>5.3%</td>
</tr>
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</table>
Postoperative bruising can be significant after EVLT, but it is much less prominent when lidocaine with epinephrine is used as the local anesthetic.

Bruising may be completely absent in patients who wear compression hose continuously during the first 3 days after treatment.

Postoperative tenderness after day 3 has also been reported, and it may be related to the amount of intravascular coagulum in the closing vessel.
EVLTI- Summary

- Treatment in less than an hour.
- Can be performed in the doctor’s office.
- Up to 98% success rate.
- Recurrence less than 7%
- Immediate relief of symptoms.
- Return to normal activity immediately – with little or no pain.
- No general anesthesia or hospitalization.
- No scars.
4 weeks after EVLT® only
After EVLT® and Sclerotherapy
Contact Information

- Danny Chan, MD
- UT-Southwestern, Department of Radiology, Division of Interventional Radiology
- 214-645-8990