Anesthesia Techniques, Sclerotherapy, Duplex-Guided Endovenous Chemical Ablation, Ambulatory Phlebectomy

Treatment/Therapy

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Disclosures

- No financial disclosures

- Discussion about foam sclerotherapy will be largely “off-label” and not FDA-approved.
CVD/VV/SpV
Treatment/Therapy

- Anesthesia Techniques
- Sclerotherapy
- Duplex-Guided Endovenous Chemical Ablation
- Ambulatory Phlebectomy
CVD/VV/SpV
Treatment/Therapy

- Anesthesia Techniques
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CVD Treatment
Anesthesia Techniques

- General
  - Higher risk pt. or more invasive procedures
- Regional (regional or nerve blocks, etc.)
- Topical
- Local
- Tumescent

CVD Treatment

Anesthesia Techniques

- **Topical**
  - Sometimes cold (ice cube) can suffice
  - Can be used on intact skin or mucus membranes
  - Usually lidocaine, prilocaine, benzocaine, or pramoxine
  - Occlusion can enhance penetration & effect
CVD Treatment
Anesthesia Techniques

- **Topical**
  - **Disadvantages:**
    1. “spotty” or uneven coverage
    2. Unable to control or determine absorption/dosage
    3. Some preparations may cause vasospasm making sclerotherapy more difficult to perform
CVD Treatment
Anesthesia Techniques

- **Topical**
  - Uses or advantages:
    2. Good for highly sensitive areas (perineal or ankles)
    3. Good for anxious or younger patients
CVD Treatment
Anesthesia Techniques

- Local anesthetics
  - Direct infiltration in operative area or wound
- Frequently combined with oral anxiolytics or IV conscious sedation
CVD Treatment
Local anesthetics

- **Esters**
  - Cocaine
  - procaine
  - Chloroprocaine
  - Tetracaine

- **Amides**
  - Lidocaine
  - Mepivicaine
  - Bupivacaine
  - Etidocaine
  - Ropivacaine
CVD Treatment
LA’s (local anesthetics)

- **Esters**
  - Faster metabolism (plasma)
  - More allergic reactions due to PABA

- **Amides**
  - Metabolized in liver

- **LA’s**
  - All have same mode of action
  - Can be bacteriostatic or bacteriocidal (↑ w/ NaHCO₃)

- Frequently combined with epinephrine:
  - Prolongs duration of anesthesia
  - Decreases blood loss
  - Concentration is 1:200,000
CVD Treatment
LA’s (local anesthetics)

- **Most commonly used in US:**
  - **Lidocaine**
    - Rapid onset, short duration
    - Generally needs epinephrine
  - **Mepivacaine**
    - Also rapid onset and causes vasoconstriction (long duration)
  - **Bupivacaine**
    - Slow onset, long duration
  - **Ropivacaine**
    - Rapid onset, long duration
CVD Treatment
LA’s (local anesthetics)

- **Allergic Reaction**
  - **Allergies to amides very rare.**
  - **Symptoms often 2º to epinephrine**
    - **CNS** (nervousness, tremors, headache)
    - **CV** (palpitations, tachycardia, hypertension, chest pain)
    - Use mepivacaine
  - **“Allergic” response often due to additives**
    - Use preservative-free solutions and add your own Epi
  - **True amide allergy?**
    - Switch to ester
CVD Treatment
LA Toxicity

**Allergic**
- **Local** (rare, usually a neurotoxicity/neural ischemia)
  - 2º to volume, toxicity, needle trauma, etc.

**Systemic**
- “Too much”
- “Wrong place”
CVD Treatment
LA Systemic Toxicity

Signs & Symptoms:

- CNS 1st, then CV
  - Metallic taste
  - Circumoral numbness
  - Lightheadedness
  - Visual & auditory disturbances
  - Slurred speech
  - Excitement (tremors, restlessness, convulsions)
  - Drowsiness & LOC
  - Hypotension & cardiac arrest

- Usually dose-dependent
CVD Treatment
LA Systemic Toxicity

Prevention:
Know signs & symptoms

Stay within guidelines & suggested doses:
LA’s listed as % = grams/100mL
So, 1% lidocaine = 100gm/100mL or 1000mg/100mL, 10mg/mL

Suggested dose limit:
Lidocaine: 7mg/kg or 300mg (or up to 500mg if Epinephrine added)
Mepivacaine 400mg
CVD Treatment
LA Systemic Toxicity

Treatment:

1. Early recognition
2. ABC’s (Airway)
3. Seizure suppression-typically benzodiazepines
4. Cardiac arrhythmia monitoring & management
5. Consider lipid emulsion (20% lipid emulsion IV)

CVD Treatment
Anesthesia Techniques

- Tumescent
  - Popularized in mid 1980’s for dermatologic & plastic surgery (liposuction)
  - Technique to deliver high-volume, low-dose anesthetic.
  - Mainly used for ambulatory phlebectomy and ETA procedures
CVD Treatment
Anesthesia Techniques

- Tumescent
  - Most popular recipe:
    - 1% lidocaine w/ 1:100,000 epinephrine
    - Added to NS or LR
    - +/- NaHCO₃ 10mEq/1000mL
  - During ETA, high volumes infused into saphenous compartment allows for vein compression, creation of heat sink and anesthesia
CVD/VV/SpV
Treatment/Therapy

- Anesthesia Techniques
- **Sclerotherapy**
- Duplex-Guided Endovenous Chemical Ablation
- Ambulatory Phlebectomy

CVD/VV/SpV
Sclerotherapy

- Liquid

- To induce venous endothelial damage that will eventually lead to vein occlusion (endosclerosis or endofibrosis).
**CVD/VV/SpV Sclerotherapy**

- Available sclerosants (not inclusive)
  - **Detergents**
    - Sodium morrhuate*
    - Ethanolamine oleate*
    - Sodium tetracadeyl sulfate*
    - Polidocanol*
  - **Osmotic**
    - Hypertonic saline, hypertonic glucose(dextrose)-saline
    - Sodium salicylate
  - **Chemical**
    - Polyiodinated iodine +/- HS
    - 72% glycerin & chromated glycerin
    - Ethanol

*FDA approved in US.*
## CVD/VV/SpV
### Sclerotherapy

<table>
<thead>
<tr>
<th>Vessel Type/Size</th>
<th>Sclerosant</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telangiectasias &lt;1mm</td>
<td>Hypertonic saline</td>
<td>11.7%</td>
</tr>
<tr>
<td></td>
<td>Sodium tetradeyl sulfate</td>
<td>0.1-0.2%</td>
</tr>
<tr>
<td></td>
<td>Polidocanol</td>
<td>0.25-0.75%</td>
</tr>
<tr>
<td></td>
<td>Glycerin</td>
<td>72% w/ lidocaine</td>
</tr>
<tr>
<td>Venulectasias 1-2mm</td>
<td>Sodium tetradeyl sulfate</td>
<td>0.25-0.4%</td>
</tr>
<tr>
<td></td>
<td>Hypertonic saline</td>
<td>23.4%</td>
</tr>
<tr>
<td></td>
<td>Hypertonic glucose/saline*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Polidocanol</td>
<td>0.5-1%</td>
</tr>
<tr>
<td>Reticular veins &gt;2mm</td>
<td>Hypertonic saline</td>
<td>23.4%</td>
</tr>
<tr>
<td></td>
<td>Hypertonic glucose/saline*</td>
<td>0.25-0.4%</td>
</tr>
<tr>
<td></td>
<td>Sodium tetradeyl sulfate</td>
<td>0.5-1.0% (lower dose = foam)</td>
</tr>
<tr>
<td></td>
<td>Polidocanol</td>
<td>0.5-1.0% (lower dose = foam)</td>
</tr>
</tbody>
</table>
Spider Veins

- Very common, especially in women
- Can be painful
Lateral Subdermic Plexus

- Very common, especially in women
- Connects superficial veins to deep system
- Remnant of embryonic deep venous system
Reticular Veins

- Enlarged, greenish-blue appearing veins
- Frequently associated with clusters of telangiectasias
- May be symptomatic, especially in dependent areas of leg
Appropriate for foam sclerotherapy in Trendelenburg position

Liquid sclerotherapy, probably at later visit
Corona phlebectatica – strongly suggests venous disease proximally
Work up reflux disease BEFORE sclerotherapy
In this case, consideration should be made to inject the thin-walled blue blebs to stop hemorrhaging, then proceed with reflux studies.
# Varicose Vein Treatments

## Injection Sclerotherapy - Complications

<table>
<thead>
<tr>
<th>Minor/Mild</th>
<th>More Serious, . . .</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
<td>Stroke</td>
</tr>
<tr>
<td>Bruising &amp; urticaria</td>
<td>Cutaneous necrosis</td>
</tr>
<tr>
<td>Hyperpigmentation 10-30%</td>
<td>Nerve injury</td>
</tr>
<tr>
<td>Telangiectatic matting (blush)</td>
<td>Allergic reaction</td>
</tr>
<tr>
<td>Superficial thrombophlebitis</td>
<td>Vasovagal w/ and w/o syncope</td>
</tr>
<tr>
<td>Visual disturbance</td>
<td>Extravasation</td>
</tr>
<tr>
<td>Headache-Migraine</td>
<td>Arteriolar injection (AV microshunts)</td>
</tr>
<tr>
<td>Localized hirsutism</td>
<td>Arterial injection</td>
</tr>
<tr>
<td>Swelling</td>
<td></td>
</tr>
<tr>
<td>Cough</td>
<td></td>
</tr>
</tbody>
</table>
Varicose Vein Treatments
Injection Sclerotherapy

General statements:

- Liquid sclerotherapy, preferably with “detergent”-type solution or glycerine should be reserved for telangiectasias (spider veins)

HYPERPIGMENTATION – COMMON

Risk Factors:
- Dark skin types—AA, Asians
- Increased serum ferritin
- Iron supplementation
- Extensive postsclerotherapy coagula
- Agents (HS>STS>POL = MOST)
- Agents (CG, glycerin, NaSalicylate = LEAST)

Technique
- Gravitational pressure
Minocycline deposition within the venous plexus

Minocycline hyperpigmentation often described “gun-metal gray” rather than the usual “golden-Brown” of hemosiderin associated pigmentation.
Sclerotherapy complication
hyperpigmentation
ulcerations
SVT & DVT
Telangiectatic matting
Varicose Vein Treatments
Injection Sclerotherapy

- To help PREVENT complications:
  - Slow, low-pressure injection technique
  - Minimal sclerosant concentration
  - Watchful, i.e. pay attention

- For significant extravasation:
  - Consider Hyaluronidase 75 units injected SQ, perivascularly.

- For suspected arterial injections:
  - Immediate heparinization, vasodilators, low molecular dextran, and consider thrombolytics
Sclerotherapy of Telangiectasias: Technique

Injection of sclerosant solution causes damage to endothelium which leads to fibrosis of vein.
Treatment of Reticular Veins

- Frequently associated with telangiectasias, their Rx may enhance results of sclerotherapy of telangiectasias
- Visualization may be improved with transillumination

Photo courtesy of N. Scott Howell, MD
CVD/VV/SpV Treatment/Therapy

- Anesthesia Techniques
- Sclerotherapy
- Duplex-Guided Endovenous Chemical Ablation
- Ambulatory Phlebectomy
Duplex-Guided Endovenous Chemical Ablation (foam)

- Least invasive method of saphenous ablation
  - Safe
  - Effective
  - Well tolerated
Duplex-Guided Endovenous Chemical Ablation

- US foam sclerotherapy-direct stick
- US foam sclerotherapy-catheter directed
- Combined mechanical-chemical ablation

- Use of US for saphenous veins or deeper tributaries, perforators,
Duplex-Guided Endovenous Chemical Ablation (foam)

1. US used to guide access
2. Tessari foam or proprietary foam OK
3. Elevate limb during and after the injection
4. Use no more than 20ml of foam
5. Most commonly, 30-40mmHg stockings used for 2 weeks post-procedure

   1. Alternative: compression bandaging X 24 hr followed by TED hose X 2 weeks

Varicose Vein Treatments
Injection Sclerotherapy-FOAM

- Neurologic side effects improved with use of ultra-low nitrogen gas\(^1\)
- Recently completed VANISH-1 and VANISH-2 clinical trials demonstrated proprietary polidocanol foam treatment of AASV or GSV resulted in acceptable improvements in patients symptom scores and visual appearance.

Varicose Vein Treatments
Injection Sclerotherapy-FOAM

- Generally very safe, with notable side effects:
- Hyperpigmentation, superficial thrombophlebitis, DVT and PE.
- Transient visual disturbances, stroke, headache, cough being notable for foam.

Varicose Vein Treatments
Injection Sclerotherapy-FOAM

- Used with sodium tetradecyl sulfate (STS) or polidocanol
- Solution mixed 1:4 with room air or carbon dioxide
- Most commonly used to treat recurrent VV, however being used for the initial treatment of truncal incompetence

Duplex-Guided Endovenous Chemical Ablation (foam)

1. Complications

- Severe but very rare: death, anaphylactic reaction, pulmonary emboli, stroke, and large areas of skin necrosis, are very rare (0.01%).
- Severe but rare: thrombophlebitis, nerve damage (saphenous, sural), DVT, or inadvertent arterial injection of the solution.
- Transient neurologic adverse effects such as visual disturbance, migraine-like headache, or confusional state may occur and are more frequent in patients with a patent foramen ovale.
- Most complications are minor, and include matting, hyperpigmentation, pain, and skin urticaria.
  - Hyperpigmentation risk is higher with increasing concentrations.

Duplex-Guided Endovenous Chemical Ablation (foam)

Complications? Safety—Systematic Review

- 9000 patients
- PE and DVT median event rate <1%.
- Visual disturbance = 1.4%
- Headache = 4.2%
- Thrombophlebitis = 4.7%
- Matting, skin staining, or pigmentation =17.8%
- pain at injection site = 25.6%.

Duplex-Guided Endovenous Chemical Ablation (foam)

Complications/Safety—an American experience comparing CO₂ to air

- N = 177
  - ↓ Visual disturbances
  - ↓ Chest tightness
  - ↓ Dry Cough
  - ↓ Dizziness
  - ↓ Nausea

- Collectively, adverse effects ↓ from 39% (19 to 49) to 11% (14 to 128) as carbon dioxide replaced air for foam preparation (P .001).

Sclerotherapy Results

Before

After Ultrasound-guided sclerotherapy of the Great Saphenous Vein and sclerotherapy of branches

Photos courtesy of Steven Zimmet, MD, FACPh
Duplex-Guided Endovenous Chemical Ablation (foam)

Results: Does it work?

- Abstract in 2006: 1411 limbs w/ incompetent GSV’s & SSV’s
- Used 1% polidocanol, 1% STS, and 3% STS foam
- 459 limbs were available for duplex imaging @ 6+ months.
- GSV remained obliterated in 88%
- SSV in 82%.

- Problem?

Duplex-Guided Endovenous Chemical Ablation (foam)

Results: Does it work?

2007 Meta-analysis of 69 studies w/ 10 RCT’s

Median complete closure of “treated vein” = 87%

Suggested that surgery > foam > liquid, . . . But too much heterogeneity to make recommendations

Duplex-Guided Endovenous Chemical Ablation (foam)

How does it stack up?

2008 Meta-analysis of RFA, EVLA, Foam

- RFA inferior EVLA & foam sclerotherapy in saphenous occlusion rate, phlebitis, DVT, and paresthesias.
- EVLA had the highest occlusion rate and least recurrence
- Foam sclerotherapy of varicose veins was associated with a higher recurrence rate in patients with saphenofemoral incompetence
- But, RCT’s needed comparing catheter techniques and comparing ablations to surgery

Duplex-Guided Endovenous Chemical Ablation (foam)

How does it stack up?

2009 Meta-analysis of RFA, EVLA, Foam, HL/S

64 trials, >12,000 limbs, avg. follow-up of ~32 mo.

- Pooled success:
  - EVLA 94%
  - RFA 84%
  - HL/S 78%
  - Foam sclero 77%

van den Bos R, Arends L, Kockaert M, Neumann M, Nijsten T.
Endovenous therapies of lower extremity varicosities: a meta-analysis.
Duplex-Guided Endovenous Chemical Ablation (foam)

How does it stack up?

2011 Meta-analysis of RFA, EVLA, Sclero, HL/S

HL/S w/ lower recurrence (non-significant)

↓ pain and “disability” w/ RFA, EVLA, sclero

Concluded that data was “low quality” but short term efficacy & safety was good w/ all the modalities and “equal” to surgery.

Duplex-Guided Endovenous Chemical Ablation (foam)

2012 Meta-analysis of foam sclerotherapy

Overall closure rates = 85%
>90 % patients reporting symptomatic improvement
Overall safe with few serious adverse events, but poor reporting

Insufficient data to determine:
- Best methodology for performance or delivery?
- Best gas mixture?

Duplex-Guided Endovenous Chemical Ablation (foam)

Notable & recent (2014):

VANISH-2 Trial: N = 232 randomized & treated
- Mostly C2 and C3
- Measured GSV response by duplex, changes in VCSS, visual appearance and pt. reported outcomes.
- GSV occluded 84.7% @ 8 weeks
- DVT rate of 5.7% seen with almost exclusively w/ 1.0% foam
- CFVTE or “EFIT” rate of 3.9%
- NO neuro events

Conclusion: Safe and effective for GSV ablation

CVD/VV/SpV
Treatment/Therapy

- Anesthesia Techniques
- Sclerotherapy
- Duplex-Guided Endovenous Chemical Ablation
- Ambulatory Phlebectomy
Surgical
Historical Advice still valid today

Galen & Oribasius of Pergamum:

1. Remove the veins, because if only ligated, they can form new varices
2. Shave and bathe the leg to be operated
3. When the leg is still warm, the surgeon has to mark varicose veins with the patient standing.
4. Extirpate varicose veins of the leg first, then at the thigh.
5. Remove clots by external compression of the limb.
Ambulatory phlebectomy

First phlebectomy performed centuries ago. Modern technique re-introduced 1950’s by Robert Muller (Swiss dermatologist).

Indications:

- Symptomatic VV, BV
- Asymptomatic VV, BV
- “Complications of VV” (bleeding, phlebitis, etc.)
Ambulatory phlebectomy

Contra-Indications:

- Infectious cellulitis or severe dermatitis (erysipelas)
- Severe edema
- Pregnancy
- Seriously ill patients (CHF, non-ambulatory, etc.)
- Anticoagulation (relative)
- Thrombophilia (relative)
- LDS
Fibrosis secondary to lipodermatosclerosis "tethers the vein" making extraction difficult

Sclerotherapy better option
Surgical Treatment of Varicose Veins: Phlebectomy

- Very esthetic method of removing varicose veins
- Usually requires only local anesthetic
- Especially useful for tributaries of GSV, SSV

Photo courtesy of Mitchel P. Goldman, MD
Surgical Treatment of Varicose Veins: Phlebectomy

- Mark veins pre-operatively with patient standing up.
- Local anesthetic w/ epi administered
- Incisions with #11 blade or 18G needle
- Incisions typically are vertical except around the knee

Photo courtesy of Mitchel P. Goldman, MD
Varicose Vein Treatment - Phlebectomy

Micro-incisional stab phlebectomy
Numerous types of hooks available

Photo on right courtesy of Mitch Goldman
Ambulatory Phlebectomy

TRIVEX:
Transilluminated powered phlebectomy

- True ambulatory & micro-incisional technique
- Local anesthetic only
Trivex- Transillumination & Resection

- Requires general or regional anesthesia w/ tumescent
- Best for large clusters of moderate to large sized superficial veins
- Removed with just 2-3 incisions

Courtesy of Dr. G. Spitz
Hach’s Perforator
Profunda Femoral Vein
Ambulatory phlebectomy

Complications

Complications are few and usually minor:

- Telangiectasias = 1.5%
- Bulla or blister formation = 1%
- Phlebitis = 0.5% (often from retained vein segment)
- Seroma = 0.5%
- Hyperpigmentation = 0.03%
- Post-op bleeding = 0.03%
- Temporary or permanent nerve injury = 0.02-0.05%

Varicose Veins
Ambulatory Phlebectomy

■ Question:
- Can phlebectomy (or sclerotherapy) be deferred?
  - 13% limbs had complete resolution of surface VV after RF alone, remaining limbs showed 88.7% had veins that decreased in size (at 6 month follow-up)\(^1\)

Ambulatory phlebectomy

Comparative Effectiveness

Probably equivalent to foam sclerotherapy

One randomized controlled trial comparing AP to sclero

1 year recurrence:
- 2% for AP
- 25% for sclerotherapy

2 year recurrence:
- 2% for AP
- 38% for sclerotherapy

CVD/VV/SpV
Treatment/Therapy
Conclusions

- **Anesthesia Techniques**
  - Know LA toxicities and recommended dosing. Know tumescent

- **Sclerotherapy**
  - Know the most common agents and recommended strengths in different size veins

- **Duplex-Guided Endovenous Chemical Ablation**
  - Know methods to make foam and indications

- **Ambulatory Phlebectomy**
  - Procedure “easy”. know contraindications and complications
Anesthesia Techniques, Sclerotherapy, Duplex-Guided Endovenous Chemical Ablation, Ambulatory Phlebectomy

Thank you.