Treatment of Vascular Lesions with Light

Denise Baker, MD

Vascular Lesion Treatment

Denise Baker, MD

The following potential conflict of interest relationships are germane to my presentation.

Speakers Bureau: Sciton Laser, Johnson & Johnson

Vascular Lesions

Cutaneous vascular lesions are one of the most common indications for laser treatments in Aesthetic Medicine
### Clinical Indications for Facial Vascular Lesions

<table>
<thead>
<tr>
<th>Congenital</th>
<th>Acquired</th>
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<tbody>
<tr>
<td>Hemangioma</td>
<td>Telangiectasias</td>
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<td>Cherry angiomas</td>
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<td>Poikiloderma</td>
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<td>Kaposi’s sarcoma</td>
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### The Treatment of Facial Vascular Lesions

#### Port Wine Stain (PWS)

Congenital malformation of superficial capillaries
Port Wine Stain

- 100% incidence at birth
- Incidence at one year: 0.3-0.5%
- Female: male ratio 1:1
- Normal cell turnover
- Lesion grows with individual; never involutes
- 85-90% located on head or neck
- Multifactorial inheritance pattern
- Complications of PWS: glaucoma, seizures, tissue/bone hypertrophy
- Associated syndromes: Sturge-Webber, Cobb, Kippel-Trenanay

Port Wine Stain Treatment

- Surgery
- Radium implants
- Cryosurgery
- Sclerotherapy
- Laser therapy

Hemangioma

Benign vascular tumor
Hemangioma

- 30% present at birth
- 10-12% incidence at one year
- Female/male ratio 3:1
- Causes increased cell turnover
- Lesion in rapid growth phase with spontaneous involution
- 60% located on head or neck
- Not inherited
- Complications include ulceration, infection, bleeding, visual axis disturbance, congestive heart failure
- Associated syndromes include Kasabach-Merritt

Hemangioma Treatment

- Surgery
- Cryotherapy
- Corticosteroids
- Interferon
- Laser therapy

Cherry Hemangioma

- Well circumscribed, small red papules
- Located anywhere on body
- May be treated with electrocautery, shave excision, or laser therapy
Venous Malformations

• Congenital
• Include varicosities, ectasias, and localized spongy masses
• Enlarge with age
• Treatments include surgery, sclerotherapy, laser therapy
• Additional imaging required

Facial Telangiectasia

• Superficial cutaneous vessels visible to human eye
• Four classifications
  – Simple or linear
  – Arborizing
  – Spider
  – Papular

Facial Telangiectasia

• Occur in 10-15% of adults and children
• 0.1-1 mm in diameter
• Usually located in mid-facial region
• Caused by alcohol, estrogen, steroids, and UV damage, trauma, or post-operative tension
• Most frequent indication for cutaneous laser treatment
**Rosacea**

- Chronic cutaneous disorder affecting 14 million in the US characterized by:
  - flushing
  - erythema
  - telangiectasia
  - edema
  - papules & pustules
  - rhinophyma

**Rosacea Treatments**

- Topical applications
  - Azeliac acid
  - Benzoyl peroxide
  - Erythromycin
  - Sulfur lotions
- Oral medications
  - Doxycycline
  - Erythromycin
  - Minocycline
  - Tetracycline
- Laser and light therapy

**Vascular Lesion**

**Lasers & Devices**
**Selective Photothermolysis**

- Selecting the proper wavelength, pulse durations, fluence, and epidermal protection allows for effective coagulation of the oxyhemoglobin within the vascular target without collateral tissue damage.
- Exposure time should be long enough to conduct heat from the red blood cells to the blood vessel wall.

**Laser Treatment of Vascular Lesions**

Chromophore: oxyhemoglobin peaks at 418nm, 540nm, 577nm

- **Argon Laser: 488/514 nm**
  - First vascular laser
  - Continuous beam results in thermal injury to melanocytes, dermis, epidermis
  - Results in 5-20% scarring and 20% pigment change

**Argon Pumped Tunable Dye Laser**

- Tune from 577-585 nm
- Results highly technique dependent and time consuming
- Requires multiple treatments


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**Copper Vapor/Copper Bromide Laser**

- 578 nm
- Almost continuous wave laser
- Thermal damage leads to scarring


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**Potassium Titanyl Phosphate (KTP): 532 nm**

- Facial vessels
- Can remove vessels with less purpura, swelling, pain, redness than pulsed dye


- KTP devices
  - Laserscope Starpulse
  - Quanta Ultrawave III
**Pulsed Dye Laser**

- First laser specifically designed to treat vascular lesions based on the principles of selective photothermolysis
- 577-595 nm
- Considered gold standard
- Revolutionized treatment of vascular lesions

**Pulsed Dye Laser**

- High melanin absorption
  - OK skin types I-IV
  - No tanned patients
  - Purpura is the clinical endpoint


**Pulsed Dye Laser Devices**

- Candela Vbeam
- Cynosure Cynergy
**Diode Laser**
- 980 nm diode
- Absorption of hemoglobin and melanin
- Appropriate for facial vessels associated with sun-damaged skin

**Diode Devices**
- Hoya ConBio V-Raser
- Medilas D SkinPulse (Germany)

**Neodymium Yttrium Aluminum Garnet: Nd:YAG 1064 nm**
- Stronger absorption in oxyhemoglobin results in selective heating of veins.
- Less scattering results in deeper penetration into skin.
- Lower absorption in melanin results in safer use.
- Non-purpuric

At 1064 nm there is enough absorption in oxyhemoglobin to selectively heat veins.

Adequate energy to heat the target...
- Heats the intravascular blood above 70 degrees
- Necrosis and contraction of the vessel wall

Laser Effect
- 585nm - Purpura
- 1064nm - No Purpura
**Selective Thermolysis of Small Vessels**

- Short pulse widths will limit high temperatures to target area.
  
<table>
<thead>
<tr>
<th>Target size</th>
<th>Time for heat conduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 μm</td>
<td>4 sec</td>
</tr>
<tr>
<td>300 μm</td>
<td>400 ms</td>
</tr>
<tr>
<td>100 μm</td>
<td>40 ms</td>
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Pulse widths for the small vessels must be on the order of 1-millisecond or less.

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**Intense Pulsed Light**

- 515-1200 nm
- Multiple wavelengths delivered simultaneously
- Can treat port wine stains, telangiectasia, hemangioma
- Bruising occurs with treatment

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**Laser Treatment of Leg Veins**
Incidence

• Incidence of telangiectasia and venulectasia
  – 41% women
  – 15% men

Leg Vein Pathology

• Superficial spider veins/telangiectasia
• Deeper reticular veins
• Protruding varicosity

Venous Anatomy
**Superficial Venous System**

- Two principal superficial veins of the lower extremity
  - Short saphenous vein (SSV)
  - Greater saphenous vein (GSV)
  - Perforating veins

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**Anatomy of Short Saphenous Vein (SSV)**

- Runs from ankle to knee
- Originates in lateral foot
- Passes posteriorly lateral to the Achilles tendon in the lower calf
- Lies directly above deep fascia in midline

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**Anatomy of Great Saphenous Vein (GSV)**

- Runs from ankle to groin
- Originates in medial foot
- Passes upward anterior to the medial malleolus
- Ascends in medial line across knee
- Continues anteromedially above deep fascia to thigh
- Passes through foramen ovale and joins deep femoral vein
**Perforating Veins**

- Pass through anatomic defects in deep fascia
- Join directly with deep veins of calf or thigh

**Deep Venous System**

- Deep veins of calf
- Deep veins of thigh

**Deep Veins of the Calf**

Three groups of deep veins in lower leg
- Anterior tibial vein (ATV)
  - Drains dorsum of foot
- Posterior tibial vein (PTV)
  - Drains lateral aspect of foot
- Peroneal vein
  - Passes upward posteriorly through calf
Deep Veins of the Thigh

- Popliteal vein (PV)
- Femoral vein (FV)
- Deep femoral vein (DFV)
- Common femoral vein (CFV)

Popliteal Vein

- Passes proximally behind knee
- Passes anteromedially in distal thigh

Femoral Vein

- Popliteal vein becomes femoral vein as it passes the distal thigh
- Largest and longest deep vein of the lower extremity
Deep Femoral Vein

- Short, stubby vein
- Originates in the muscle of the lateral thigh

Common Femoral Vein

- Forms by joining of femoral vein and deep femoral vein in proximal thigh

Calf Muscle Pump

- Muscle pump of the calf and thigh provide venous return
- Squeezing of vein segment occurs when muscle contraction increases pressure with fascial muscle compartments
Indications for Laser Leg Vein Treatment

- Refractory non-cannulizable vessels
- Telangiectatic matting
- Angiogenic flushing
- Resistant to sclerotherapy
- Vessels smaller that diameter of 30G needle

Gold standard for leg veins is sclerotherapy

Lasers & Light Sources for Leg Vein Treatment

- Pulsed Dye 585-605 nm
- KTP 532 nm
- Alexandrite 755 nm
- Diode 810 nm
- Nd:YAG 1064 nm
- IPL 515-1200 nm

What Wavelength is Preferable?


<table>
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<tr>
<th>Laser</th>
<th>Patients Achieving 75% Clearance At 3 Months</th>
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<tr>
<td>1064 nm Nd:YAG</td>
<td>88%</td>
</tr>
<tr>
<td>810 nm Diode</td>
<td>29%</td>
</tr>
<tr>
<td>755 nm Alexandrite</td>
<td>33%</td>
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Vascular Lesion Treatment: General Guidelines

Clinical Indications for Facial Vascular Lesions

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  • Hemangioma
  • Port wine stain
  • Venous malformations
  • Lymphangiomas

Acquired
  • Telangiectasias
  • Cherry angiomas
  • Pyrogenic granulomas
  • Venous lakes
  • Poikiloderma
  • Kaposi’s sarcoma

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Contraindications

- Photosensitizing medications
- Presence of tattoo in treatment area
- Psoriasis
- Accutane
- Recent UV exposure
- Gold therapy
- Vitiligo

Pre-Treatment Guidelines

- Avoid Retin-A, AHA, glycolics one week prior to treatment
- Avoid sun exposure, tanning, and self tanning products for 2 weeks prior to treatment
- Use sunscreen SPF 30 or more on treatment areas
- Shave area 24 hours prior to treatment (if applicable)
- Prophylax with anti-viral if patient prone to herpetic outbreak

Clinical Endpoint

- Vascular spasm
- Vessel disappear
- Vessel ruptures
- Vessel darkens and borders become indistinct
Post Treatment Guidelines

• Ice or cold compresses will ease redness, bruising, swelling
• Do not rub treated areas when bathing; pat dry
• Avoid harsh topical agents
• Avoid sun exposure for two weeks post procedure
• Use SPF 30 or greater on treated area

Treatment Challenges

• Deeper, larger diameter vessels
• Hydrostatic pressure
• Less oxygenated blood
• Multiple vessels with varying diameters

Important System Features for Vascular Lesion Treatment

• Wavelength that is better absorbed by hemoglobin than surrounding tissue
• Wavelength should reach full depth of target vessel
• Deliver sufficient energy to damage vessel without damaging surrounding skin
Important Features

• Exposure time for energy delivery long enough to coagulate vessels without damaging surrounding tissue
• Epidermal cooling

Vascular Lesion Treatment
Before & After

Cherry Angioma: Pulsed Dye
Port Wine Stain: PDL

1064 nm Nd:YAG
Telangiectasia
1064 nm Nd:YAG

Venulectasia

1064 nm Vein Treatment

1064 nm Vein Treatment

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Vascular Lesion
Treatment Complications

Complications
- Purpura
- Hyper/Hypopigmentation
- Telangiectatic matting
- Pain
- Thrombosis
- Epidermal damage
- Incomplete clearance
- Scarring
- Dermatitis
- Pyogenic granuloma

Purpura
- Common side effect of flash-lamp pulsed-dye laser treatment
- Disappears 1-2 weeks after treatment
- Energy needed to cause purpura varies with skin type, vessel size, pulse duration, wavelength
Purpura: PDL laser

Purpura: PDL Laser

Hyperpigmentation/Hypopigmentation

- Association between pigmentation and FLPDL
  - 57% post laser induced hyperpigmentation
  - 10% post laser induced hypopigmentation
- Hyperpigmentation possibly caused by hyperactive melanocytes and vascular inflammation
- Hypopigmentation uncommon; seen with treatment of port wine stain
Hyperpigmentation FLPDL

Hypopigmentation: Argon