NON-INVASIVE EVALUATION OF VENOUS DISEASE

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VENOUS DISEASE

- Chronic venous diseases (CVDs) include a spectrum of clinical findings ranging from spider telangiectasias and varicose veins to debilitating venous ulceration. Varicose veins without skin changes are present in about 20% of the general population, and they are slightly more frequent in women.
ANCIENT DISEASE

- References to varicose veins are found in early Egyptian and Greek writings and confirm that venous disease was recognized in ancient times. A votive tablet in the National Museum in Athens showing a man holding an enlarged leg with a varicose vein.
VENOUS WALL

- Composed of three layers: intima, media, and adventitia.
- Venous valves are an extension of the intimal layer, have a bicuspid structure, and support unidirectional flow.
Venous system consist of 3 interconnected parts:
- Deep system
- Perforating system
- Superficial system
VENOUS BLOOD FLOW
WHAT IS VENOUS INSUFFICIENCY DISEASE?

Progressive condition caused by poor return of blood to the heart

Symptoms include:

- Pain
- Varicose veins
- Leg heaviness & fatigue
- Swollen limbs
- Skin changes

Risk factors include:

- Family history
- Multiple pregnancies
- Obesity
- Standing profession
HOW VENOUS INSUFFICIENCY OCCURS

1. Column of blood increases pressure in leg veins
2. Vein valves fail
3. Results in reflux and poor venous drainage
4. Increased pressure causes surface veins to become varicose
MECHANISM OF VENOUS DISEASE

Increased venous hydrostatic pressure

Predisposing factors

Axial veins

Antegrade progression

Retrograde flow (reflux)

Tributaries

Increased vein wall tension

Endothelial cell injury

Leukocyte infiltration

Inflammation

MMPs

Endothelial cell hyperpolarization

Venous smooth muscle relaxation

ECM degradation

Valve dysfunction

Wall dilation

Chronic venous disease

C1 Spider veins

C2 Varicose veins

C3 Edema

C4 Skin changes

C5 Healed ulcer

C6 Active ulcer
VENOUS SYSTEM ABNORMALITIES

- Increased pressure in large veins (e.g., from chronic standing, obesity or pregnancy)
- Sequential valve failure
- Dilation of peripheral veins (varicose veins)
- Increased venous capillary pressure (with chronic venous insufficiency)
- Inflammatory and ischemic injury
  - Results in skin discoloration, thickening and breakdown
- May result in venous ulceration
CLINICAL EXAMINATION
CEAP CLINICAL CLASSIFICATIONS

CEAP 2
Varicose veins

CEAP 3
Swelling

CEAP 4
Skin changes

CEAP 6
Skin ulcer
CLINICAL ETIOLOGY ANATOMY
PATHOPHYSIOLOGY (CEAP) CLINICAL CLASSIFICATION

Class:

0: Asymptomatic; no visible or palpable signs
1: Spider veins, reticular veins, telangiectasias
2: Varicose veins
3: Edema
4a: Skin changes with hyperpigmentation and eczema
4b: Skin changes with lipodermatosclerosis and atrophie blanche
5: Healed ulcer
6: Active ulcer
PRESENTATION IN 1000 PATIENTS

- Class 0: 11.3%
- Class 1: 5.9%
- Class 2: 38.3%
- Class 3: 20.4%
- Class 4: 21.6%
- Class 5: 4.3%
- Class 6: 8.2%
- Primary: 68.3%
- Secondary: 24.7%
- Primary + secondary: 6.1%
- Congenital: 0.9%
- Superficial: 90.7%
- Perforating: 24.2%
- Deep: 28.8%
- Reflux: 81.5%
- Obstruction: 1.8%
- Reflux + obstruction: 16.7%
CEAP CLASS 2: VARICOSE VEINS

- Dilated, frequently tortuous veins with thickened walls
- Cause: Incompetent valves
  - Primary
    - Majority of varicose veins
    - Originate in superficial system
  - Secondary
    - Originate in deep system
      - Deep venous insufficiency
      - Deep vein obstruction (DVT)
CEAP CLASS 3: EDEMA

- Untreated, venous insufficiency may result in edema
- Venous hypertension forces fluid into lymphatic and interstitial spaces
- Leg swells due to poor venous return
  - Pain and discomfort, especially in distal calf and ankle
- May include incompetence in deep, superficial and perforating veins
CEAP CLASS 4: SKIN CHANGES

- In addition to varicose veins and edema, these patients present with:
  - Class 4a:
    - Hyperpigmentation (especially in distal and medial calf)
    - Stasis dermatitis (venous eczema)
  - Class 4b:
    - Lipodermatosclerosis
    - Atrophie blanche
CEAP CLASS 5: HEALED VENOUS ULCER

- All venous systems may be involved
- Persistent reflux and venous hypertension results in microcirculatory and inflammatory changes in the skin
  - Eventually leads to ulceration
  - Patient may go back and forth between CEAP 5 and 6
CEAP CLASS 6: ACTIVE ULCER

- Most severe stage of venous disease
  - Involves superficial, deep and perforating veins
  - Persistent venous hypertension results in microcirculatory and inflammatory changes to skin
NON-INVASIVE TESTS FOR VENOUS SYSTEM

- Venous Duplex
- Hand held Doppler
- Plethysmography
- Venogram – invasive – rarely needed now
VENOUS DUPLEX ULTRASOUND
ASSESSMENT OF SUPERFICIAL SYSTEM
PERFORATOR
PERFORATOR
DEEP VENOUS SYSTEM

- Mickey’s face is the CFV as the face and the LSV and the CFA as the ears
DEEP VEINS
DVT COMPRESSION TEST
ARTERIOVENOUS FISTULA
HAND HELD DOPPLER

- Continuous wave doppler
- Ideally connected to audio signal & printout
- Target vein assess for reversal of flow
- The more reversal, the more reflux
PLETHYSMOGRAPHY

• Plethysmographs are device that measure volume change
  – Impedance
  – Photo
  – Air
AIR PLETHYSMOGRAPHY

- Able to detect changes in venous limb volume with movement
- Used to assess
  - Venous insufficiency
  - DVT
PLEHYSMOGRAPHY FOR VENOUS INSUFFICIENCY
THANK YOU