Consequences of Venous Disorders

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Consequences of Venous Disorders

- Financial Disclosure
- Conflict of Interest
- Off Label Usage
Consequences of Venous Disorders

• Superficial Venous Disease
• Deep Venous Disease
• Embolic Disease
Consequences of Venous Disorders

• Superficial Venous Disease
• Deep Venous Disease
• Embolic Disease
• It’s all connected
• Don’t exist in a vacuum
Consequences of Venous Disorders

• Anatomy
  – Superficial Venous System
    • Drains skin
    • All superficial veins drain into LSV/GSV
  – Deep Venous System
    • Drains muscle
    • Drains superficial veins
    • TV>PV>SFV>CFV>CIV>IVC
Superficial Venous Disease

- Epidemiology
- Pathophysiology
- Presentation
- Treatment
- Outcomes
Superficial Venous Disease

- Epidemiology
  - 50% of adults
  - Advancing Age
  - Gender
  - Obesity
Superficial Venous Disease

- Pathophysiology (leg)
  - Calf Muscle Pump (peripheral heart)
    - Calf muscles, fascial compartments
    - Superficial venous compartment
    - Deep venous compartment
    - Outflow vein (and valves)
  - Malfunctions in sedentary patients
  - Malfunctions in obese patients
Superficial Venous Disease

• Pathophysiology (chest)
  – Thoracoabdominal pump
    • Inspiration decreases thoracic pressure
    • RA receives augmented venous return
  – Diminished in obese patients
  – Diminished in COPD patients
  – Diminished in CHF patients
Superficial Venous Disease

- Pathophysiology
  - Venous Hypertension
    - Obesity
    - Outflow obstruction
Superficial Venous Disease

- **Pathophysiology**
  - Venous Hypertension
    - Obesity
    - Outflow obstruction
  - Valvular Incompetence
Superficial Venous Disease

- Pathophysiology
  - Valvular Incompetence
    - Heredity
    - Pregnancy
      - Progesterone
      - Circulating blood volume
    - Trauma
    - Thrombophlebitis
    - Prolonged Standing
  - We’ll talk more about this later
Superficial Venous Disease

• Presentation
  – Aesthetics
  – Pain
  – Burning
  – Itching
  – Heaviness
  – “Cellulitis”
  – Thrombophlebitis
  – RLS
Superficial Venous Disease

• Physical Exam
  – Gaiter Area
  – Posterior Calf
  – Lateral Thigh/ LSVC
Superficial Venous Disease

• Physical Exam
  – Telangiectasia C1
  – Reticular Veins C1
  – Varicose Veins C2
Superficial Venous Disease

• Physical Exam
  – Edema C3
  – Staining/Eczema C4a
  – Lipodermatosclerosis C4b
  – Healed Ulcer C5
  – Active Ulcer C6
Superficial Venous Disease

• Imaging
  – Ultrasound
    • Venous mapping
    • DVT study is less helpful
Superficial Venous Disease

- **Treatment**
  - **Conservative**
    - Risk factor modification
      - Weight loss
      - Increase activity
    - Compression garments
Superficial Venous Disease

• Treatment
  – Thermal Ablation (EVLT/RFA)
    • Energy delivered to vein wall to sclerose incompetent segment
    • Works well for straight veins
    • Skin veins drain into (competent) deep veins
Superficial Venous Disease

- Thermal Ablation Procedure
  - Compression hose
  - Ambulate 30 min daily
  - Ibuprofen
  - U/S in 2 weeks
Superficial Venous Disease

- Thermal Ablation Outcomes
  - EVLT
    - 96% primary closure (Auckland)
  - RFA
    - 96% primary closure (Ontario)
Superficial Venous Disease

• Thermal Ablation Outcomes
  – Complications
    • Pain 100%
    • Bruising
    • Phlebitis
    • Nerve Injury/Paresthesia 0-12%
    • Incomplete closure 0-3%
    • DVT/PE 0-16%
    • Skin burn 0-7%
    • Infection
Superficial Venous Disease

• Thermal Ablation Outcomes
  – Complications
  – Failures
    • Obesity
    • Vein Size
    • Compression (compliance)
Superficial Venous Disease

- Non-thermal Ablation
  - Pharmacomechanical
  - Adhesive
Superficial Venous Disease

- Treatment
  - Thermal Ablation (EVLT/RFA)
  - Ambulatory Phlebectomy
    - Works well for large tortuous veins
    - Controls phlebitis
    - Often in conjunction with EVLT
    - Bleeding
    - >95% effective
Superficial Venous Disease

- Treatment
  - Ambulatory Phlebectomy
Superficial Venous Disease

- **Treatment**
  - Thermal Ablation (EVLT/RFA)
  - Ambulatory Phlebectomy
- Works well for large tortuous veins
- Often in conjunction with EVLT
- Bleeding
- >95% effective
Superficial Venous Disease

- **Treatment**
  - **Perforating Veins**
    - Foam sclerotherapy
      - Varithena
      - STS/Asclera foam
        » 1 mL 0.5%
        » 1:4 air mixture
Superficial Venous Disease

- **Treatment**
  - **Perforating Veins**
    - Foam sclerotherapy
      - Varithena
      - STS/Asclera foam
        » 1 mL 0.5%
        » 1:4 air mixture
Superficial Venous Disease

• Treatment
  – Perforating Veins
    • Outcomes
      – > 70% closure
      – Varies with size
    • Complications
      – Failed Closure
      – Reconstitute Trunk
      – DVT (usu. calf vein)
Superficial Venous Disease

- Treatment
  - Thermal Ablation (EVLT/RFA)
  - Ambulatory Phlebectomy
  - Sclerotherapy
    - Perforating veins
    - Superficial veins (reticular, thread)
Superficial Venous Disease

• Case Presentation #1
  – 65 year-old retired teacher
  – 30 year history of pain and swelling
  – RLS
Superficial Venous Disease

• Case Presentation #1
Superficial Venous Disease

• Case Presentation #2
  – 44 year old AA male
  – Referred by primary MD
  – 50 yard RLE claudication
  – DM II, 30 pk yr smoker, HTN, Chol, fam hx
Superficial Venous Disease

• Case Presentation #2
  – 44 year old AA male
  – Referred by primary MD
  – 50 yard RLE claudication
  – DM II, 30 pk yr smoker
  – Biphasic Doppler on right
  – 1+ DP on the left
  – ABI R: 0.86 L: 0.96
Superficial Venous Disease

• 44 year old AA male
  – Referred by primary MD
  – 50 yard RLE claudication
  – DM II, 30 pk yr smoker
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Superficial Venous Disease

• Case Presentation #2
  – 44 year old AA male
  – Referred by primary MD
  – 50 yard RLE claudication
  – Biphasic Doppler on right
  – 1+ DP on the left
  – ABI R: 0.86  L: 0.96
  – Referred for CTA
  – Referred for venous mapping
Superficial Venous Disease

- Case Presentation #2
  - CTA shows diffuse calcific disease
  - Mapping shows severe GSV reflux
Superficial Venous Disease

• Case Presentation #2
  – 12 mm RCIA stent
  – EVLT of R GSV
    (after much deliberation)
Superficial Venous Disease

- Case Presentation #2
  - “Come to Jesus” Talk
  - ASA QD
  - 30 min walking QD
  - Smoking cessation
Superficial Venous Disease

- Case Presentation #2
  - “Come to Jesus” Talk
  - ASA QD
  - 30 min walking QD
  - Smoking cessation
  - Able to walk ad lib
Superficial Venous Disease

- Case Presentation #2
  - “Come to Jesus” Talk
  - ASA QD
  - 30 min walking QD
  - Smoking cessation
  - STEMI 6 weeks later
  - Remaining left GSV used as conduit
Superficial Venous Disease

- **Summary**
  - SVD is common (especially in an aging population)
  - SVD is a chronic medical condition with real medical consequences (including pain, dysfunction, up to and including limb loss)
  - There are safe and effective conservative and minimally invasive therapies for SVD
Deep Venous Disease

- Epidemiology
- Pathophysiology
- Presentation
- Treatment
- Outcomes
Deep Venous Disease

- Epidemiology
  - Advancing age
  - Gender
  - Obese
  - Heredity
  - Trauma
  - Prior DVT
Deep Venous Disease

- Pathophysiology
  - Reflux/Insufficiency/Stasis
  - Thrombosis
    - Acute
    - Chronic
    - Both
  - Outflow Obstruction
    - Syndromes
Deep Venous Disease

- **Reflux**
  - Valve function
    - Open to allow forward flow
    - Close to prevent standing column of blood
Deep Venous Disease

• Reflux
  – Treatment
    • Compression for life
Deep Venous Disease

• Outflow Obstruction
  – DVT
  – Anatomic compression syndromes
    (more on this later)
Superficial Venous Intervention

- Deep Veins (obstruction)

- 32 year old male

- 4 years s/p femoral DVT

- CC swelling, superficial varicose veins
Deep Venous Disease

• Thrombosis
  – Epidemiology
  – Pathophysiology
  – Complications
  – Diagnosis
  – Treatment
  – Outcomes
Deep Venous Disease

• Epidemiology
  – 300,000 new cases DVT annually
  – Males > females
  – 120,000 will suffer recurrent VTE
  – DVT is third most common CV disease
  – $24 billion to treat DVT annually
Deep Venous Disease

- Etiology of DVT
  - Virchow’s Triad
  - Malignancy
  - Obesity
  - Pregnancy
  - Previous VTE
  - General anesthesia
  - Hereditary thrombophilia
  - Anatomy
Deep Venous Disease

• Acute DVT Complications
  – Local
    • Pain
    • Phlegmasia
  – Distant
    • Pulmonary Embolism
Deep Venous Disease

• Chronic DVT Complications
  – Local
    • Pain
    • Edema
    • Post Thrombotic Syndrome
  – Distant
    • Pulmonary Hypertension
Deep Venous Disease

- DVT Diagnosis
  - Clinical Suspicion (Well’s Predictors)
    - Malignancy
    - Paralysis/immobilization
    - Bedridden
    - Major surgery
    - Previous DVT
    - Complete leg swelling
    - Calf swelling >3 cm c/w contralateral
Deep Venous Disease

• DVT Diagnosis
  – Clinical Suspicion
  – Physical Exam
  – D-Dimer
  – Ultrasound
    • NPV > 99%
    • Poor at determining acuity
Deep Venous Disease

• Treatment
  – ACCP
    • Distal asymptomatic DVT
      – Serial imaging
    • Distal symptomatic DVT
      – Treat
    • Proximal
      – Treat
Deep Venous Disease

- Treatment
  - Acute
    - Non-fractionated heparin
    - LMWH
      - pregnancy
      - malignancy
  - Subacute
    - Warfarin
    - NOAC
Deep Venous Disease

- Treatment of Iliofemoral DVT
  - (These patients are different)
    - More symptomatic
    - Greater disability
    - Greater morbidity
    - Predisposed to long-term complications
Deep Venous Disease

- Treatment of Iliofemoral DVT
  - Anticoagulation
    - Does prevent propagation
    - Does reduce risk of PE
    - Does not resolve clot
    - Does not prevent valve damage
    - Does not prevent post thrombotic syndrome
Deep Venous Disease

• Post Thrombotic Syndrome
  – Chronic venous insufficiency in DVT patients
  – Ambulatory venous venous hypertension
    • Capillary damage
    • Interstitial leakage
    • Fibrin deposition
  – 25% will develop severe symptoms
  – Permanent disability
Deep Venous Disease

- Post Thrombotic Valve Dysfunction
  - Thrombus extends through valves
  - Even if recannalized, valves remain fixed
Deep Venous Disease

- Catheter Directed Therapy (CDT) for Iliofemoral DVT
  - Infusion
  - Mechanical
  - Pharmacomechanical
Deep Venous Disease

• Rational for CDT
  – (These patients are different)
  – Remove thrombus
  – Relieve pain
  – Restore function
  – Reduce PE
  – Preserve valve function
  – Reduce PTS
Deep Venous Disease

• Thrombolysis
  – Patient Selection
    • Symptomatic acute iliofemoral DVT
    • No prior ipsilateral proximal DVT
    • Ambulatory
    • Reasonable life expectancy
    • Phlegmasia
    • Worsening symptoms despite systemic therapy
    • Symptomatic with extension to IVC (iliocaval)
Deep Venous Disease

- Infusion (Pharmacologic) Thrombolysis
  - Catheter placed within thrombus
  - TPA infusion
  - ICU admission
  - Bleeding complications
Deep Venous Disease

• Mechanical Thrombolysis
  – Various devices
  – Remove thrombus
  – May not be “stand alone”
  – Hemolysis
  – Lytic administration
Deep Venous Disease

• Pharmacomechanical Thrombolysis
  – Combine thrombolytics and mechanical clot removal
  – Allows for single session treatment
  – Few major bleeding complications
Deep Venous Disease

• Combination Therapy
  – One or more of the above
  – Angioplasty and stenting
  – Useful for acute on chronic disease
Case

- 35 year old female admitted with 5 day history of worsening, severe RLE swelling
- PE 3 years prior due to contraceptive ring
- US extensive RLE DVT
Case
Deep Venous Disease

• Thrombolysis Outcomes
  – Technical success > 90%
  – Primary patency > 80% at one year
  – Reduction in PTS
    (time to recanalization)
  – Complications
    • Failure to lyse
    • Major hemorrhage
Deep Venous Disease

• Summary
  – Deep venous disease is a source of acute and chronic morbidity
  – When patients remain symptomatic despite adequate systemic therapy, CDT may be indicated
  – CDT may improve long-term outcomes when compared to anticoagulation alone
  – Many patients will require life long therapy (compression and/or anticoagulation)
Anatomic Compression

• Venous Compression Syndromes
  – Veins are thin walled
  – Easily compressed by adjacent structures
  – Leads to stenosis and thrombosis
Anatomic Compression

- Venous Thoracic Outlet Syndrome
  - Scalene Anticus Syndrome
  - Cervical Rib Syndrome
  - Costoclavicular Syndrome
  - Paget-Schroeder
Anatomic Compression

• Case
  – 21 year old “pitcher”
  – 36 hours acute RUE pain and swelling
  – Brachial DVT and Cephalic SVT
**Anatomic Compression**

- **May Thurner Syndrome**
  - RCIA compression of LCIV
  - Spur formation in iliac vein
  - Suspect in young patient without predisposing factors
Anatomic Compression

• May Thurner Syndrome
  – 60 year old female
  – 3 week h/o LLE swelling s/p travel
Anatomic Compression

- May Thurner
  - 19 year old male 1 year s/p “GSW” to head
  - 3 week h/o leg swelling
  - Extensive DVT in LLE
Anatomic Compression

• Summary
  – Anatomic compression should be suspected in young patients with no risk factors for DVT
  – CDT is effective in the treatment of these disorders
  – Combination therapy (including surgery) is typically required
Embolic Disease

- Epidemiology
- Pathophysiology
- Presentation
- Treatment
- Outcomes
Embolic Disease

• Epidemiology
  – 300,000-600,000 cases annually (1 in 1,000)
  – 50,000-200,000 deaths
  – Male = female
  – Advancing age, Obesity, Heredity
  – Leading cause of death in hospitalized patients
  – Mortality has decreased over the last 25 years
Embolic Disease

• Pathophysiology
  – Thrombus dislodged from lower extremity
  – Travels through heart, occluding pulmonary arteries
  – Ventilation perfusion mismatch, increased pulmonary vascular resistance, and reduced cardiac output combine to result in hypoxia
Embolic Disease

- Presentation (variable)
  - Pleuritic chest pain
  - Shortness of breath
  - Tachycardia
  - Tachypnea
  - Hypoxia
  - Hypotension
  - Hemodynamic collapse
Embolic Disease

- **Pulmonary Embolism Diagnosis**
  - Clinical Suspicion
    - Hemoptysis
    - DVT
    - Pleuritic chest pain
Embolic Disease

- Pulmonary Embolism Diagnosis
  - Clinical Suspicion
    - Modified Wells Criteria
      - DVT (3)
      - No other likely diagnosis (3)
      - Previous VTE
      - Tachycardia
      - Recent Surgery/ Immobilization
      - Hemoptysis
      - Cancer
Embolic Disease

• Pulmonary Embolism Diagnosis
  – Clinical Suspicion
    • Pulmonary Embolism Rule-out Criteria
      – Rules out PE when absent:
        » Unilateral LE swelling
        » Hemoptysis
        » Prior DVT/PE
        » Recent surgery/trauma
        » Age > 50
        » Tachycardia
Embolic Disease

• Pulmonary Embolism Diagnosis
  – Clinical Suspicion
  – Physical Exam
  – D-Dimer
  – EKG
  – ABG
  – CT PA gram
Embolic Disease

• Treatment
  – Prevention
    • Ambulation
    • Compression
    • Anticoagulation
    • IVC filtration
  – Anticoagulation
  – Thrombolysis
Embolic Disease

• IVC Filtration
  – Rationale
    • Places a mechanical barrier between the site of thrombosis and the lungs (Nature’s Filter)
    • Regardless of coagulation status
Embolic Disease

• IVC Filtration
  – ACCP Indications
    • Acute PE or proximal DVT with contraindication to anticoagulation
    • VTE in unstable patient in addition to anticoagulation
    • Massive PE undergoing CDT
Embolic Disease

- IVC Filtration
  - AHA Indications
    - Acute PE or proximal DVT with contraindication to anticoagulation
    - VTE in unstable patient in addition to anticoagulation
    - VTE with failure of anticoagulation therapy
Embolic Disease

• IVC Filtration
  – SIR Indications:
    • PE or Proximal DVT and…..
    • Progression of VTE disease on adequate anticoagulation
    • Complication of anticoagulation
    • Poor cardiopulmonary reserve
    • Free floating thrombus
    • Pre-op lysis
Embolic Disease

• IVC Filtration
  – SIR Expanded Indications (Prophylaxis)
    • Trauma
      – Closed head injury, Spinal cord injury, Long bone fractures
    • Multiple risk factors in pre-op patient
    • Malignancy
    • DVT/ PE in pregnancy
    • Bariatric Surgery, Neurosurgery
Embolic Disease

• IVC Filtration
  – Devices
    • Greenfield 1973
    • Stainless steel
    • The Standard
Embolic Disease

- IVC Filtration
  - Devices
    - Bird’s Nest 1984
    - 40 mm IVC
Embolic Disease

- IVC Filtration
  - Devices
    - Simon Nitinol 1989
    - Low profile
    - Expands in-vivo
Embolic Disease

- IVC Filtration
  - Devices
    - Gunther Tulip 1997
    - Apical hook
Embolic Disease

- IVC Filtration
  - Devices
    - Gunther Tulip 1997
    - Apical hook
    - “Optional”
Embolic Disease

• IVC Filtration
  – Devices
    • G2 2007
    • Based on Recovery
    • Failed deployment
    • Prone to perforation
    • Prone to fracture
    • Led to FDA communications 2010 and 2014
Embolic Disease

• IVC Filtration
  – Devices
    • Convertible 2016
    • Leaves stent behind
Embolic Disease

• IVC Filtration Outcomes
  – Placements have been decreasing since 2010
  – Reduce risk of PE
  – Do not reduce overall mortality
  – Less than half of optional filters are actually ever removed
Embolic Disease

• IVC Filtration
  – Retrievable filters
  – Retrieval rates are poor
    • Technically impossible
    • Lost to follow-up
    • Develop permanent indication
Embolic Disease

- IVC Filtration
  - Complications
    - IVC Thrombosis 2%
      - Chicken vs. Egg
    - Recurrent PE 5%
Embolic Disease

• IVC Filtration
  – Complications
    • IVC Thrombosis
    • Recurrent PE 5%
    • Filter Complications
      – Migration
      – Fracture
      – Embolization
Embolic Disease

- Anticoagulation
  - ACCP
    - Observation for low risk sub segmental PE
    - UFH/LMWH for acute PE
    - VKA or NOAC for 3 months for larger PE
    - Systemic (not CDT) thrombolytics for PE with hypotension
Embolic Disease

• Anticoagulation
  – ACCP
    • Observation for low risk sub segmental PE
    • UFH/LMWH for acute PE
    • VKA or NOAC for 3 months for larger PE
    • Systemic (not CDT) thrombolytics for PE with hypotension
    • CDT for hypotensive patients with bleeding risk, failed systemic lytics, or impending death
Embolic Disease

• Catheter Directed Therapy
  – Rationale for CDT
    • Administer thrombolytics directly into thrombus
    • Better drug delivery, less systemic effect
  – (These patients are different)
    • Correct RV strain/ hemodynamics
    • Improve ventilation/perfusion
    • Prevent chronic pulmonary hypertension
Embolic Disease

• Catheter Directed Therapy
  – ACC/AHA CDT Indications
    • Massive PE
      – Hypotension
      – Shock
    • Sub massive PE
      – RV strain
      – PESI indicating poor outcome
Embolic Disease

• Catheter Directed Therapy
  – Only for the sickest
  – Invasive ICU admission
  – Bleeding complications
  – Contraindications
Embolic Disease

• **Anticoagulation Outcomes**
  – <5% mortality in first year
  – <5% recurrence in first year
  – <5% develop pulmonary hypertension
Embolic Disease

- Catheter Directed Therapy Outcomes
  - Lower in hospital mortality
  - Improvement in hemodynamics
  - ? Pulmonary hypertension
  - ? Overall survival
Embolic Disease

• Summary
  – VTE is common and can be life threatening
  – Anticoagulation is good for treating the majority of DVT and PE
  – Filters are imperfect but getting better
  – Filters are probably overused
  – CDT can rapidly improve hemodynamics in very sick patients with VTE
Consequences of Venous Disorders

• References
  – ACCP management of VTE: http://journal.chestnet.org/article/S0012-3692(15)00335-9/fulltext
Consequences of Venous Disorders

• References
Consequences of Venous Disorders

• References
What a relief!!
Enjoy the rest of your day

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