# THE HEARTSUMMIT 2018

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Venous Thromboembolism and Pulmonary Embolism Prevention, Detection, and Acute Care Management Strategies

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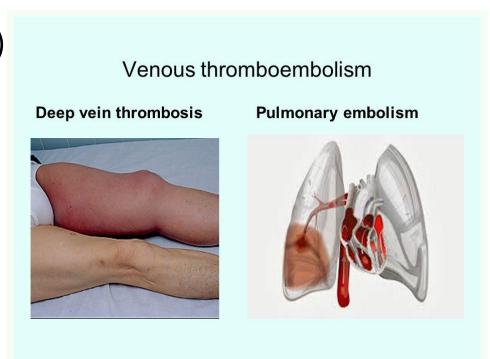
## Objectives

- 1. Identify prevention measures, risk factors, and symptoms for venous thromboembolism.
- 2. Recognize which diagnostic test to order for individualized patients.
- 3. Determine the best course of treatment for each patient in the acute care settings for DVT/PE.
- 4. Understand EKOS and how it is revolutionizing the treatment of DVT/PE.



#### Venous Thromboembolism: What is it?

- Venous thromboembolism (VTE) is a blood clot that starts in a vein.
- Third leading vascular diagnosis after heart attack and stroke.
- Types:
  - Deep Vein Thrombosis (DVT)
  - Pulmonary Embolism (PE)

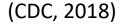




#### Risk Factors of VTE

- Immobility
- Major surgery
- Recent injury or trauma
- Estrogen based medication (HRT)
- Pregnancy
- Cancer
- Obesity
- Advanced Age







# Symptoms of VTE

DVT	PE
Swelling	Shortness of breath
Pain	Chest pain/discomfort worse on inspiration or cough
Redness/Streaking	Hemoptysis
Skin hot to touch	Hypotension
	Lightheadedness
	Fainting



### Diagnosis: DVT vs. PE

Checking your symptoms on Google

DVT: Venous Duplex



- PE: CTA Chest (gold standard)
  - ABG
  - ECHO
  - D dimer
  - VQ Scan (if CTA Chest contraindicated)



# Well's Criteria for Pulmonary Embolism

Clinical signs and symptoms of DVT	No 0	Yes +3
PE is #1 diagnosis OR equally likely	No 0	Yes +3
Heart rate > 100	No 0	Yes +1.5
Immobilization at least 3 days OR surgery in the previous 4 weeks	No 0	Yes +1.5
Previous, objectively diagnosed PE or DVT	No 0	Yes +1.5
Hemoptysis	No 0	Yes +1
Malignancy w/ treatment within 6 months or palliative	No 0	Yes +1



#### Treatment for VTE

- LMWH: Lovenox 1mg/kg SQ q 12hr
- Warfarin- most cost effective
- Direct Oral Anticoagulants (DOACs)
  - Eliquis (Apixaban) 10mg PO BID x 7 days then decrease to 5mg BID PO BID
  - Xarelto (Rivaroxaban) 15mg PO BID x21 days then decrease to 20mg PO daily
  - More convenient to patient
  - Few bleeding complications



# Treatment (cont.)

Systemic TPA

Table 3 Contraindications to use of alteplase <sup>a</sup>		
Absolute contraindications	Relative contraindications	
Internal bleeding Previous intracranial hemorrhage History of a cerebral vascular accident within the past 3 months Recent intracranial or intraspinal surgery or trauma Intracranial neoplasm Arteriovenous malformation or aneurysm Known bleeding diathesis	Age >75 y Current use of anticoagulation Pregnancy Noncompressible vascular punctures Traumatic or prolonged car- diopulmonary resuscitation (<10 min) Recent internal bleeding (within 2-4 wk) History of chronic, severe, and poorly controlled hypertension Severe uncontrolled hypertension on initial examination (systolic blood pressure >180 mm Hg or diastolic blood pressure >110 mm Hg) Dementia Remote ischemic stroke (>3 mo) Major surgery within preceding 3 weeks	
<sup>a</sup> Based on information from Jaff et al <sup>4</sup> and Ouellette and Patocka. <sup>22</sup>		



# Treatment (cont.)

- Catheter Directed Thrombolysis (CDT)
  - Wire is passed through the embolus, followed by placement of a multi side hole infusion catheter through which a thrombolytic drug is infused over 12 to 24 h
  - Delivery of the drug directly into the thrombus is expected to be as effective as systemic therapy but to cause less bleeding because a much lower dose of the drug is used. (Kearon & Sista, 2015).
  - Can be used to treat DVT and PE.
- High risk patients with shock from acute PE with contraindication to systemic thrombolytic therapy
  - ECMO
  - Surgical embolectomy
  - IVC Filter



# **Embolectomy Video**





#### **EKOS: Mechanism of Action**

#### Fibrin Separation

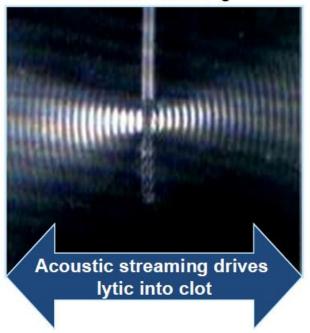
Non-cavitational ultrasound separates fibrin without fragmentation of emboli





Braatan et al. Thrmob Haemost 1997;78:1063-8. Francis et al. Ultrasound in Medicine and Biology, 1995;21(5):419-24. Soltani et al. Physics in Medicine and Biology, 2008; 53:6837-47.

# Active Drug Delivery Drug is actively driven into clot by "Acoustic Streaming"





#### Benefits

- Shorter hospital stay
- Lower risk of bleeding when compared to catheter directed thrombolysis (CDT)
- Uses 68% less blood thinners when compared to standard CDT
- Requires 4x less drug disease than systemic delivery
- Reduces risk of post thrombotic syndrome



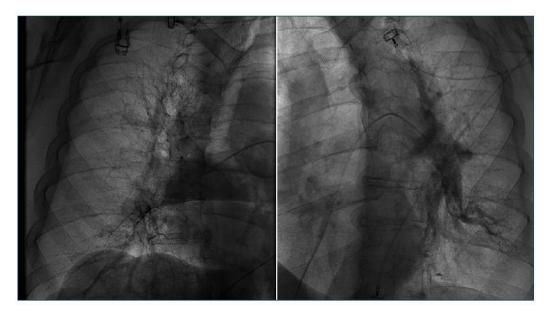
#### Research

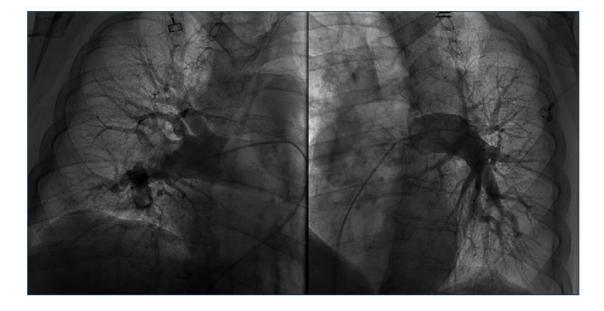
- Ultima Study- EKOS worked better than using anticoagulation alone, improved RV dysfunction in 24 hr without increasing bleeding risk.
- Seattle II- improved RV function, decreased pulmonary HTN, minimized risk of intracranial bleeding.
- Optalyse- same efficacy, half the time, half the dose



# **EKOS**

Before After







#### How do we know treatment was effective?

- Direct angiography.
- Echo findings: RV function should have improved
- Improved symptoms.





#### Prevention

- Weight loss
- Exercise
- Avoid long periods of inactivity
- When traveling stop every 1-2 hours to stretch legs
- Wear compression hose when traveling
- Avoid HRT if possible
- LMWH for at risk inpatients



#### Echo before and after video



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# Case Study

- Presentation: 28 y/o AAF presented with complaints of sudden shortness of breath, lightheadedness, and chest pain. Developed pain and swelling to the LLE several weeks prior, evaluated at OSH. US performed to the LLE, negative for a DVT. 2 weeks later, pain to the LLE suddenly stopped.
- Findings: EKG revealed ST at 170 BPM. Laboratory data revealed elevated troponin (likely secondary to PE), d dimer >4.00, and hypoxia. She was started on lovenox and supplemental O2.
- CTA Chest revealed large burden of PA emboli bilaterally, just short of saddle PE.
- Initial echo revealed LVEF 60 to 65%, moderately enlarged right ventricle, moderately reduced RV systolic function, moderately dilated right atrium, moderate-severe tricuspid regurgitation, and moderate pulmonary hypertension

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# Case Study (cont).

- Diagnostic Clues
  - Recent LE pain/swelling
  - Symptoms
  - EKG findings
  - Lab- hypoxia (pO2 56), elevated ddimer
  - Echo findings (RV strain)
- Risk factors
  - Overweight (455lb)
  - Taking Loestrin for birth control



# Case study (cont)

- Systemic TPA- Alteplase
- Started on Eliquis 10mg BID x7 days then 5mg BID
- Hematology outpatient workup



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