Tisha Wang, MD is Co-Director and Co-Founder of the Pulmonary Embolism Response Team (PERT) at UCLA. Born and raised in Texas, Dr. Wang came to California in 2002 for her internal medicine residency at UCLA and was recruited to stay on to complete a pulmonary and critical care fellowship. She joined the faculty at UCLA in 2008 and her many roles have included fellowship program director, director of the liver transplant intensive care unit, and clinical division chief.

Her clinical interests include pulmonary and critical care complications of liver disease, pulmonary embolism, and rare lung disease. Dr. Wang is the PI on multiple clinical studies studying pulmonary alveolar proteinosis and is the Clinical Director and Vice President of the PAP patient foundation. Based on an idea originally created by Dr. Richard Channick who is now her colleague at UCLA, Dr. Wang and her cardiology and interventional radiology colleagues started the multidisciplinary PE Response Team at UCLA in 2017 which has brought PE care to a new level. She is now working with all the University of California hospitals to create an outpatient protocol for the care of post-PE patients as part of the UCAPE (University of California Alliance on PE Care) initiative.

Outside of UCLA, Dr. Wang serves as the Vice Chair of the Education Committee for the American Thoracic Society and chairs the Nominating Committee for the California Thoracic Society. She is a staunch advocate for women in medicine, medical educators, and patients with rare lung disease.
Management of Acute Pulmonary Embolism – New Approaches

Tisha Wang, MD
Clinical Division Chief
Fellowship Program Director
Co-Director, UCLA PE Response Team

Disclosures

• Consultant for “Pharming” regarding Therapeutics in Rare Lung Disease
• No disclosures relevant to today’s topic
Outline/Objectives

- Overview of PE prevalence and impact
- Triage and risk stratification
- Updates in the management of low risk PE
  - Who can I treat as an outpatient?
  - The era of DOACs
  - When not to treat
- Updates in the management of high risk PE
  - Thrombolysis and more
  - PERT teams
- Guideline updates on treatment duration

Pulmonary Embolism = Fear

- We are scared of missing the diagnosis
- We are scared of the diagnosis once it is made
- We are scared of making a decision about therapy for the diagnosis
- Even once we have made a decision, we are scared of implementing therapy for the diagnosis
- We are scared about what is going to happen to the patient months to years after the diagnosis
- We are scared that the diagnosis will recur despite successful treatment
The Impact of Venous Thromboembolism

- DVT 2 Million
- Post-thrombotic Syndrome 600,000
- PE 600,000
- Deaths 60,000
- Silent PE 1 Million
- Pulmonary Hypertension 30,000

Estimated Cost of VTE Care $1.5 Billion/year


The Impact of Pulmonary Embolism

- Third leading cause of cardiovascular death
- Most common preventable cause of in-hospital death
- Likely to be growing public health problem with the aging population
  - Clinical data shows highest incidence in those 60-70 yrs of age
  - Autopsy data shows highest incidence in those 70-80 yrs of age
Risk Stratification of PE

- Non Massive (low risk)
  - Normal RV and biomarkers
  - Mortality < 1%
- Submassive (intermediate risk)
  - +/- RV dysfunction
  - +/- Biomarkers
  - Mortality 3-20%
- Massive (high risk)
  - Shock
  - Mortality 25-65%

If significant PE found, order BNP, troponin, TTE.

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Scoring Systems for PE Severity

<table>
<thead>
<tr>
<th>Clinical Variable</th>
<th>PESI</th>
<th>sPESI</th>
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<tbody>
<tr>
<td>Age</td>
<td>+10</td>
<td>1</td>
</tr>
<tr>
<td>Male sex</td>
<td>+10</td>
<td>1</td>
</tr>
<tr>
<td>History of cancer</td>
<td>+10</td>
<td>1</td>
</tr>
<tr>
<td>History of heart failure*</td>
<td>+10</td>
<td>1*</td>
</tr>
<tr>
<td>History of chronic lung disease*</td>
<td>+10</td>
<td>1*</td>
</tr>
<tr>
<td>Pulse ≥ 110 beats/min</td>
<td>+10</td>
<td>1</td>
</tr>
<tr>
<td>Systolic blood pressure &lt; 100 mm Hg</td>
<td>+10</td>
<td>1</td>
</tr>
<tr>
<td>Respiratory rate ≥ 30 breaths/min</td>
<td>+10</td>
<td>1</td>
</tr>
<tr>
<td>Temperature &lt; 36°C</td>
<td>+10</td>
<td>1</td>
</tr>
<tr>
<td>Altered mental status</td>
<td>+10</td>
<td>1</td>
</tr>
<tr>
<td>Oxygen saturation &lt; 90%</td>
<td>+10</td>
<td>1</td>
</tr>
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</table>

**PESI Score**

<table>
<thead>
<tr>
<th>Score</th>
<th>Range</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;66</td>
<td>I</td>
<td>0–1.6%</td>
</tr>
<tr>
<td>66–85</td>
<td>II</td>
<td>1.7%–3.3%</td>
</tr>
<tr>
<td>86–105</td>
<td>III</td>
<td>3.2%–7.1%</td>
</tr>
<tr>
<td>106–125</td>
<td>IV</td>
<td>4.0%–11.4%</td>
</tr>
<tr>
<td>&gt; 125</td>
<td>V</td>
<td>10.0%–24.5%</td>
</tr>
</tbody>
</table>

**PESI** – Class I appropriate for discharge

**sPESI** – Greater or equal to 1 point warrants consideration for inpatient therapy.
Treatment Options in 2019

• Anticoagulation
  • Unfractionated heparin
  • Low molecular weight heparin
  • Fondaparinux
  • DOACs: apixaban, rivaroxaban, dabigatran, edoxaban
  • Warfarin

• Thrombolytic Therapy/Mechanical Options
  • Catheter-directed vs systemic thrombolysis
  • Thrombectomy, IVC filter, ECMO, etc

Who Can I Safely Manage as an Outpatient?

• For hemodynamically stable pts without concerning features, scoring systems i.e. PESI, sPESI, or Hestia criteria can help identify low-risk pts suitable for outpatient treatment of acute PE
• Systemic reviews/meta-analyses have shown that outpatient therapy is safe in this select group
• Low risk of dying from PE + low risk of bleeding from anticoagulation = the sweet spot
Scoring Systems for PE Severity

**TABLE 2: HESTIA CRITERIA**

If any of the below are answered "Yes," the patient should NOT be treated as an outpatient.

1. Hemodynamically unstable?
2. Thrombolysis or embolectomy necessary?
3. Active bleeding or high risk of bleeding?
4. Oxygen supply to maintain oxygen > 90% > 24 hours?
5. Pulmonary embolism diagnosed during anticoagulant treatment?
6. In severe pain needing IV pain medication > 24 hr (or multiple doses in the ED)?
7. Medical or social reason for treatment in hospital > 24 hr?
8. Creatinine clearance less than 30 mL/min?
9. Severe liver impairment or disease?
10. Pregnant?
11. Documented history of heparin-induced thrombocytopenia?

Who Can I Safely Manage as an Outpatient?

**Emergency Department Discharge of Pulmonary Embolus Patients**

W. Frank Peacock, MD, Craig L. Coleman, PharmD, Deborah B. Duncko, MD, Samuel Francis, MD, Christopher Kahrbel, MD, Catherine Kay, MD, Jeffrey A. Kline, MD, Jacob Mansenfeld, MD, Peter Wildgoose, PhD, Jim Xiang, PhD, and Adam J. Singer, MD

- 114 ED patients with low-risk PE (defined by Hestia) randomized to early discharge on rivaroxaban vs standard care
- Primary outcomes: hospital LOS and bleeding events within 90 days
- Mean hospital LOS 4.8 hrs vs 33.6 hrs in standard care
- No bleeding events, recurrent VTE, or deaths at 90 days
- Median total treatment costs within 30 days significantly less in early discharge cohort ($1,496 vs. $4,234).
Interactive Question

• A 45 yr old healthy female presents to the ED with SOB + chest pain. She is afebrile with HR 82, BP 110/75, RR 16, and O2 sat 96% on RA. D-dimer returns positive and CTA chest shows a RML segmental PE. Urine pregnancy test is negative. The ED recommends admission but the patient is eager to go home since it is her birthday.

• Which of the following is the most appropriate plan of care for this patient?
  A. Admit her to the hospital for IV heparin
  B. Discharge her on Coumadin with an INR check in 5 days
  C. Discharge her on Apixaban
  D. Discharge her on Dabigatran
This patient is a good candidate for outpatient therapy of her PE. She does not have comorbidities or an increased chance of bleeding with anticoagulation and her vital signs are normal.

Options for outpatient therapy without bridging include apixaban and rivaroxaban. Both dabigatran and edoxaban require bridging with parenteral agents.

For VTE without cancer, all direct oral anticoagulants are recommended over vitamin K antagonist (VKA) therapy (Grade 2B) based on 2016 ACCP Guidelines.
Management Options – The DOACs

**Rivaroxaban**
- 15 mg twice daily for 21 days
- 20 mg once daily

**Apixaban**
- 10 mg twice daily for 7 days
- 5 mg twice daily

**Edoxaban**
- Parenteral agent with UFH or LMWH for 5-10 days
- 60 mg once daily (30 mg once daily if CrCl 15-50 cc/min or weight < 60 kg or on P-gp inhibitors)

**Dabigatran**
- Parenteral agent with UFH or LMWH for 5-10 days
- 150 mg twice daily

Legend:
- UFH = unfractionated heparin; LMWH = low molecular weight heparin
- Red: need for higher dose initially
- Purple: need for parenteral agent initially
- Green: once daily dosing
- Blue: twice daily dosing

Management Options - Which To Choose?

- **No head to head trials between DOACs**
- **Rivaroxaban and edoxaban are once daily**
- **Rivaroxaban and apixaban do not require “bridging” therapy**
- **Rivaroxaban has to be taken with food**
- **Dabigatran should be avoided in coronary disease and in patients with dyspepsia**
- **Reversal agents FDA approved for dabigatran (idarucizumab) and rivaroxaban/apixaban (andexanet)**
Management Options - Which To Choose?

- Lowest bleeding risk with apixaban
  - In 4 NEJM trials: major bleeding risk: 0.6% with apixaban, 1.1% with rivaroxaban, 1.4% with edoxaban, and 1.6% with dabigatran
  - One recent retrospective study of >15,000 patients on either rivaroxaban or apixaban found decreased risk of recurrent VTE (HR 0.37) and decreased risk of major bleeding events (HR 0.54) with apixaban

- Edoxaban is only NOAC studied in setting of cancer
  - In recent RCT, edoxaban shown to be noninferior to dalteparin (LMWH) – rate of recurrent VTE was lower (7.9% vs 11.3%) but rate of major bleeding was higher (6.9% vs 4.0%) with edoxaban

Management Options – When To Choose VKA or LMWH?

- Scant data for DOACs in morbid obesity, massive PE, liver disease, concomitant antiplatelet therapy, antiphospholipid syndrome
- Avoid DOACs in pregnancy and significant renal insufficiency
- Cost/insurance coverage can also be significant barrier
Subsegmental PEs – A Consequence of Overdiagnosis

- Untreated, subsegmental PE are unlikely to recur (<1%)
- In cohort of 93 patients with isolated subsegmental PE, rate of major bleeding (5%) exceeded that of PE recurrence (1%)
- Three mo of anticoagulation can carry 2-3% risk of major hemorrhage and 0.4% risk of fatal bleeding
- 2016 ACCP Update: For pts with subsegmental PE and no DVT, guideline suggests surveillance over AC when risk of VTE recurrence is low (Grade 2C) and AC over surveillance when risk of recurrence is high (Grade 2C)

Subsegmental PEs – Increasing Data to Not Treat

- In a single-center study, Canadian researchers retrospectively studied 222 patients with PE detected on CTPA between 2014-16
  - Of 71 isolated subsegmental PE, 87% were anticoagulated -- similar to 94% anticoagulation rate in those with proximal PE
  - Among those with subsegmental PE who were anticoagulated, 42% were seen in ER or readmitted within 3 mo for reasons other than VTE and 34% had decreased hemoglobin levels or received blood transfusions
What about the Submassives and Massives?

**Submassive PE: Full Dose, Half Dose, or No Dose Lytics?**

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**PEITHO:**
RCT studying thrombolysis for submassive PE

**Purpose:**
- To investigate the benefit and safety of thrombolysis (Tenecteplase) vs placebo for normotensive patients with high-intermediate risk PE (RV dysfunction + elevated troponin)

**Design**
- Double blind, placebo controlled
- 1006 patients

Meyer et al. NEJM 2014; 370:1402
PEITHO: Results

However mortality was unchanged: 1.2% in tenecteplase group vs. 1.8% in placebo group (P=0.42).

PEITHO – Risk of Bleeding

- Thrombolysis associated with increased extracranial bleeding (6% vs 1%), major bleeding (12% vs 2%), and hemorrhagic stroke (2% vs 0.2%).
- In those patients > age 75, rates of extracranial bleeding were even higher (11% vs 0.6%)
Catheter Directed Lytic Therapy for PE

- Direct infusion of lytic agent into the clot
- Allows for higher local concentration and use of lower doses of lytic agent
- Can measure PA pressures during administration
- Ability to fragment clot or allow greater surface area penetration of the lytic agent

Interactive Question

- Which of the following is true regarding catheter directed thrombolysis for PE?
  A. The risk of bleeding is significantly less when compared head-to-head to the use of systemic thrombolysis
  B. CDT has been shown to reduce the risk of chronic thromboembolic pulmonary hypertension when utilized in massive PE patients
  C. A randomized trial has shown improvement in echocardiographic parameters with the use of CDT in submassive PE patients
  D. The 2016 ACCP Guidelines recommends its use for high risk submassive PEs
Trials in CDT – Few and Far Between

- **ULTIMA**: only RCT completed in CDT: enrolled 59 submassive PE pts with primary endpoint RV/LV ratio at 24 hrs after therapy initiation
  - Compared CDT (US guided) vs. anticoagulation alone
  - In CDT group, mean decrease in RV/LV ratio was 0.30±0.20 compared to 0.03±0.16 (P<0.001) in heparin only group
- **Seattle II**: multicenter prospective trial evaluating 150 pts (most with submassive PE) who underwent CDT
  - Primary outcome: change in RV/LV ratio based on CT
  - Found reduction in mean RV/LV ratio from 1.55 to 1.13 (P<0.0001) within 48 hrs of therapy initiation and mean PA systolic pressure decreased from 51 to 37 mmHg (P<0.0001)
  - 10% risk of major bleeding but no intracranial bleeds

Circulation. 2013;129:479–486

*J Am Coll Cardiol Intv* 2015;8:1382–92.
CDT in Submassive/Massive PE – Additional Data

- Meta-analysis performed in 594 patients from 35 studies who received any type of CDT
  - Overall 86.5% success rate with 7.9% rate of minor complications and 2.4% rate of major complications
  - Almost all performed without preceding IV lysis
- "PERFECT" registry examined 101 pts with submassive and massive PEs who underwent any type of CDT
  - Success rate 86% in massive PEs; 97% in submassive PEs
  - Mean PA pressure improved by 27%
  - No major complications or hemorrhages

Unknowns about Catheter Directed Therapy for PE

- Does it improve long term outcome (CTEPH, disability) compared to AC alone?
- Is it safer than systemic thrombolysis?
- Is one technique/device superior (e.g. US enhanced thrombolysis vs. thrombolysis alone)? PERFECT registry suggests technique does not matter.
- Where does it fit in the treatment algorithm?
Current Society Guidelines for CDT

- **AHA:** Depending on local expertise, either catheter embolectomy or fragmentation is reasonable for pts with massive PE and contraindications to lysis. CDT is also reasonable for pts with massive PE who remain unstable after receiving systemic lysis (Class 2A; level of evidence C).

- **ACCP:** In pts with acute PE with hypotension and who have a high bleeding risk, failed systemic lysis, or shock that is likely to cause death before systemic lysis can take effect, if appropriate expertise is available, CDT is suggested over no such intervention (Grade 2C).

Systemic Thrombolysis

- Indicated for hemodynamically unstable patients with PE without contraindication
- Can be given via peripheral IV – dose typically 100 mg alteplase over 2 hrs
- Associated with decreased risk of recurrent PE or death
- Risk of intracranial hemorrhage up to 3%

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Thrombolysis, n/N (%)</th>
<th>Heparin, n/N (%)</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recurrent PE or death</td>
<td>13/128 (10.2)</td>
<td>24/128 (19.0)</td>
<td>0.45 (0.22-0.90)</td>
</tr>
<tr>
<td>Recurrent PE</td>
<td>5/128 (3.9)</td>
<td>9/128 (7.1)</td>
<td>0.61 (0.23-1.62)</td>
</tr>
<tr>
<td>Death</td>
<td>8/128 (6.2)</td>
<td>16/128 (12.7)</td>
<td>0.47 (0.20-1.19)</td>
</tr>
<tr>
<td>Major bleeding</td>
<td>26/128 (21.9)</td>
<td>15/128 (11.9)</td>
<td>1.98 (1.00-3.99)</td>
</tr>
</tbody>
</table>

Fear of Thrombolysis

- Meta-analysis of 16 trials with total of >2,000 patients
- Major bleeding 9.2% vs. 3.4%
- Intracranial bleeding 1.5% vs 0.2%
- Major bleeding not significantly increased in patients ≤65 yrs of age

JAMA. 2014 Jun 18;311(23):2414-21

Thrombolysis: More Data on Risk of Bleeding
Does Thrombolytic Therapy have Long Term Benefits?

**Impact of Thrombolytic Therapy on the Long-Term Outcome of Intermediate-Risk Pulmonary Embolism**

Stavros V. Konstantinides, MD, PhD, a,b Eric Vicaut, MD, PhD, a Thierry Danays, MD, a,c Cecilia Becattini, MD, d Laurent Bertocletti, MD, PhD, a Jan Beyer-Westendorf, MD, e Helene Bouvzvat, MD, f Francois Coutazaud, MD, PhD, a Claudia Delles, MD, a,b Daniel Daeschmied, MD, f Klaus Enpen, MD, a Emile Ferrari, MD, a,c Nazareno Galbi, MD, f David Jiménez, MD, PhD, g Maciej Kostrubiec, MD, h Matija Kozak, MD, g Christian Kupatt, MD, a Irene M. Lang, MD, g Mareike Lankel, MD, g Nicolas Meneveau, MD, PhD, a Massimiliano Palazzini, MD, b Piotr Pruszczyk, MD, b Matteo Rugolotto, MD, b Aldo Salvi, MD, b Olivier Sanchez, MD, a,c,d Sebastian Schellong, MD, g Bozena Sobkowicz, MD, PhD, g Guy Meyer, MD a,c,d,h

Conclusion: No evidence that more aggressive upfront treatment of acute PE will decrease likelihood of long-term sequelae (echo findings, CTEPH, symptoms)

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**Suction Embolectomy (VORTEX)**

- Rapid removal of clot
- Less invasive than surgery with few complications, mostly local to sheath site
- No large case series
- Resource intensive
Pulmonary Embolectomy

- An option for massive PE patients who cannot receive lysis or remain unstable after lysis
- Also considered in those with right heart thrombi located in close proximity to a PFO

47 patients underwent acute embolectomy over 5 yr period
- 26% in cardiogenic shock, 11% in cardiac arrest
- Overall 6% operative deaths but 1-yr survival of 86%
ECMO: An Option in PE Care

- Biocompatible Tubes
- Centrifugal Pumps
- Small, efficient oxygenators

With All of These Options: Who You Gonna Call? UCLA PERT!

CLOTBUSTERS!
PE Response Teams - Objectives

- Respond quickly to patients with massive and submassive PE
- Provide best therapeutic options available for each patient
- Leverage the input of a multidisciplinary team of experts
- Coordinate care among services involved in care of PE
- Develop protocols for the range of available therapies
- Collect data on clinical presentation, treatment efficacy, and outcomes (short and long-term)
Early Data on PERT

A Multidisciplinary Pulmonary Embolism Response Team
Initial 30-Month Experience With a Novel Approach to Delivery of Care to Patients With Submassive and Massive Pulmonary Embolism

Christopher Kabrhel, MD, MPH; Rachel Rosovsky, MD, MPH; Richard Channick, MD; Michael R. Jeff, DO; Ido Weinberg, MD; Thoralf Sundt, MD; David M. Dudzinski, MD, JD; Josanna Rodriguez-Lopez, MD; Blair A. Perry, CCRC, BS; Savannah Harshbarger, BS; Yuchiao Chang, PhD; and Kenneth Rosenfield, MD

- 399 activations in 3 years with survival to discharge: 86.4%
- 62% anticoagulation only, 18% IVC filters, 9% catheter directed lysis, 4% surgery, 3% IV lysis, 2.5% ECMO

Early Data on PERT

Changes in treatment and outcomes after creation of a pulmonary embolism response team (PERT), a 10-year analysis

Rachel Rosovsky1, Yuchiao Chang2, Kenneth Rosenfield3, Richard Channick4, Michael R. Jeff5, Ido Weinberg1, Thoralf Sundt6, Alison Witkin7, Josanna Rodriguez-Lopez8, Blair A. Perry2, Savannah Harshbarger7, Praveen Haritharan1, Christopher Kabrhel1

- No difference in mortality or bleeding pre- vs post-PERT, despite increase in number of interventions
One Value of PERT

The Patient Survives – Now What?
The Aftermath: Long-term Sequelae

• Those followed long-term have an increased risk of death beyond acute phase
  • 4X risk of death for up to 8 yrs post-VTE in a 5,000 pt series from the Netherlands
  • Increased risk of death persisted to 30 yrs post-VTE in a Danish study of 120,000 pts
  • 1-yr mortality of 29% in Canadian study of 67,000 pts
• One of major causes of death in all these studies was recurrent VTE

The Aftermath: Long-term Sequelae

• Concern for long-term development of chronic thromboembolic pulmonary hypertension
  • Incidence reported in ~3% range
  • Riociguat FDA approved as therapy
  • Potentially curable with pulmonary thromboendarterectomy
• Concern for “post-PE syndrome”
  • 11.3% with NYHA III-IV at 9 mo follow-up
  • Median 6MWD 5th percentile compared to age/sex matched normals at 12 mo follow-up
Treatment Duration – 2016 ACCP Guidelines

- Anticoagulants should be stopped at 3 mo in pts with PE provoked by transient risk factor (Grade 1B if high bleeding risk; Grade 2B if low-mod bleeding risk)
- Anticoagulation should be given for 3 mo in pts with a first unprovoked VTE and high risk of bleeding (Grade 1B) but should be extended without scheduled stop date in pts with low-mod risk of bleeding (Grade 2B)
- For pts with unprovoked PE who are stopping anticoagulation, guideline suggests aspirin to prevent recurrent VTE if no contraindication (Grade 2B)

Chest 2016;149:315-352

Management Options for Extended Therapy

<table>
<thead>
<tr>
<th>Indication</th>
<th>Dalteparin</th>
<th>Apixaban</th>
<th>Edoxaban</th>
<th>Rivaroxaban</th>
</tr>
</thead>
<tbody>
<tr>
<td>DVT/PE</td>
<td>CCl &gt; 30 mL/min and 5-10 d LMWH or UFH then 150 mg, BID</td>
<td>CCl &gt; 30 mL/min then 10 mg, BID x 7 d then 5 mg, BID</td>
<td>CCl &gt; 30 mL/min and 5-10 d LMWH or UFH then 60 mg, daily</td>
<td>CCl &gt; 30 mL/min then 15 mg, BID x 21 d then 20 mg, daily</td>
</tr>
<tr>
<td>Secondary Prevention</td>
<td>CCl &gt; 30 mL/min</td>
<td>CCl &gt; 30 mL/min</td>
<td>CCl &gt; 30 mL/min or weight &lt; 60 kg or on Pgp inhibitors, use 30 mg, daily</td>
<td>CCl &gt; 30 mL/min min</td>
</tr>
<tr>
<td>DVT/PE</td>
<td>150 mg, BID</td>
<td>2.5 mg, BID</td>
<td>Not studied</td>
<td>20 mg, daily</td>
</tr>
<tr>
<td>Do not use CCl &lt; 30 mL/min or on dialysis</td>
<td>Do not use CCl &lt; 30 mL/min or on dialysis</td>
<td></td>
<td>Do not use CCl &lt; 30 mL/min or on dialysis</td>
<td></td>
</tr>
</tbody>
</table>

Tech Vasc Interventional Rad 2017; 20:141-151
Summary

- Risk stratification is crucial in determining the optimal therapy for PE
- Select low risk PEs can be managed as an outpatient – sweet spot of low risk of bleeding + low risk of death
- Subsegmental PEs should not be treated if risk of recurrence is low
- DOACs are becoming standard of care for long-term treatment of PE with few exceptions
- Systemic lysis is underutilized but remains treatment of choice (w/o contraindications) in massive PE – rate of intracranial bleeding in non-elderly patients is extremely low

Summary

- The role of CDT remains unclear but can be considered in experienced centers for both high risk submassive and massive PE patients
- The optimal treatment of high risk submassive PEs remains unclear but PERT teams are emerging in many centers with the goal of standardizing care and prioritizing the multidisciplinary model
- Patients with unprovoked PEs should be considered for indefinite anticoagulation if bleeding risk is low
- Post-PE, patients have a significant risk of functional impairment, recurrence, and death
Thank you for your attention!!
Happy to take questions…