Basics of Pulmonary Embolism: Role Of The History, Exam, Biomarkers

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Disclosure Statement of Financial Interest

I, Raghu Kolluri, have a financial interest/arrangement or affiliation with one or more organizations that could be perceived as a real or apparent conflict of interest in the context of the subject of this presentation.

- Consultant/ Advisor – UNCOMPENSATED
  - Bard, BD, Boston Scientific, BTG, Inari, Innovein, Intervene, Janssen, Medtronic, Philips, Vascular Insights, Vesper Medical
- Board Member – VIVA Physicians Inc, 501c
- Medical Director – Syntropic Core lab, 501c

Case Study

- 65 yr old ex-service man
- Consultant to special forces
- Returning from Tashkent → Berlin → Columbus
- Left leg swelling
  - Berlin docs – “Knee OA”
  - Columbus – Could not complete his daily 5 mile run
- Stopped at 4 miles
- Saw one of our cardiologists (was high school cross country coach)
- No significant PMHx
- No Hx of prior VTE
- No Hx of Cancer

Diagnosis of PE

Pre-test Probability

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- CT – PE - Bilateral
Case Study

CTA – Sensitivity and specificity

- Difficult to assess since CTA is now the gold standard
- PIOPED II: sensitivity - 83%; specificity - 96%
- Review of CTA: Thirteen diagnostic and 11 follow up studies
  - Variable prevalence of PE (19–79%), patient groups, and method quality.
  - Sensitivity (53 - 100%), specificity (79 - 100%), false negative rate (1.0 - 10.7%).
  - Dual energy CT: visualize clots and perfusion defects
  - Additional assessment of perfusion may improve sensitivity


Clot burden

- Central thrombus in the main, right or left PA
- Correlates with 30 day mortality
- Clot burden measured by percentage lung involvement or semiquantitative indices (Mastora or Qanadli)
  - Does not correlate with adverse outcomes


Hospital Admission Vs Outpatient Management

Hestia Criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>ACNP guidelines – “Stable PE”</th>
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<tbody>
<tr>
<td>PESI; No biomarker/echo</td>
<td>“In patients with low-risk PE and whose home circumstances are adequate, we suggest treatment at home or early discharge over standard discharge (e.g. after first 5 days of treatment) (Grade 2B).”</td>
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<tr>
<td>No PESI; No biomarker/echo</td>
<td>“Suggest that patients who satisfy all of the following criteria are suitable for treatment of acute PE out of hospital:</td>
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<td>• Clinically stable with good cardiopulmonary reserve;</td>
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<td>• No contraindications such as recent bleeding, severe renal or liver disease or Severe thrombocytopenia (i.e. &lt; 70,000 mm³);</td>
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<td>• Expected to be compliant with treatment</td>
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<td>• Patient feels well enough to be treated at home”</td>
</tr>
</tbody>
</table>


No PESI; No biomarker/echo

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  - CT – PE Bilateral
  - Echo in clinic
- Stopped at 4 miles
- Saw one of our cardiologists (was high school cross country coach)

1. There is normal left ventricular systolic function.
2. Mild distal lateral RV wall motion abnormality; normal RV size and systolic function.
3. No significant valvular abnormality; trace MR, trace TR, trace PI.
4. The right ventricular systolic pressure is estimated to be 25-30 mmHg.
5. There is no pericardial effusion.

Physiologic surrogate for RA and PA

- RV-LV > 1.0 on axial, or
- RV-LV > 0.9 on 4 chamber view
- PA diameter should be less than Ascending Aorta

RV Dysfunction on Echo Predicts 90-Day Mortality

![Graph showing RV Hypokinesis = 20.9% and Normal RV Function = 14.8% over days from diagnosis.]

Admit to the hospital

RV dysfunction

![Images showing RV dysfunction and related findings.]

Case Study – Duplex

![Duplex ultrasound image.]


RV Dysfunction on Echo Predicts 90-Day Mortality

RV dysfunction

Case Study – Duplex
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- CT – PE Bilateral
- Echo in clinic
- Trop – Mild elevation; BNP - WNL

Exam
- In sweat shirt and pants
- Pacing in the room
- "I want to get the heck out of here. I am not wearing that hospital gown"
- BP – 110/70; HR – 76; O2 Sat – 96% RA; Lungs – Clear; Normal S1 S2, no JVD, No P2 prominence; No leg swelling

Severity prognostication based on hemodynamics/ Clinical Features

Cardiospecific Biomarkers

391 patients/ Single center
Case study

- Discussed options
  - Discussed CDT / IVC filter - Declined
  - Discussed DOAC Vs Warfarin
  - Discharged around 40 hours later on Enox -> Warfarin

6 week follow up

- VQ – no mismatch
- Duplex – No DVT

Summary

- PE care is complex team sport
- Hemodynamic assessment
  - Imaging + biomarkers + clinical gestalt + individual tailored therapy (Cardio pulmonary status) = Good outcomes