Putting It All Together: What Is The Modern Algorithm For Management Of Massive And Submassive PE

Ido Weinberg, MD
Medical Director, VASCORE
Assistant Professor of Medicine
Harvard Medical School
Massachusetts General Hospital

Start Anticoagulation Early. Remember: LMWH >> UFH

Cochrane Database Syst Rev. 2017 Feb 9;CD001100
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In Massive Pulmonary Embolism Consider UFH First. Remember Prompt Thrombolysis

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Not all PE are Created Equal
Treatment is Really Simple:

- Improved early clot resolution
- Reduced pulmonary arterial pressure
- Improved lung perfusion
- Improved early angiographic flow

PIOPED Investigators. Chest. 1990; 97: 528-33
Goldhaber SZ. et al. Lancet. 1993; 341(8844): 517-11
Daniels LB. AJC. 1997; 80: 184-8

There is One Obvious Downside...

The Higher the PE-Related Risk, the Easier to Administer Lytics

ECMO Reduces Mortality of Sickest PE Patients

Table 3. Treatment modalities employed in patients with massive PE.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Overall (n=496)</th>
<th>Post-ECMO (n=311-314)</th>
<th>Pre-ECMO (n=182)</th>
<th>p-value vs. ECMO</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECLS</td>
<td>12 (2.4%)</td>
<td>12 (4.8%)</td>
<td>0 (%)</td>
<td>0.300</td>
</tr>
<tr>
<td>Anticoagulation</td>
<td>12 (2.4%)</td>
<td>12 (4.8%)</td>
<td>0 (%)</td>
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</tr>
</tbody>
</table>

Other aggressive therapies were made possible


For catheter based therapies to be considered in massive PE, rapid implementation needs to be available
Case

- 50-year-old man presents with CP and SOB after flying non-stop to Boston from India
- He is found to have bilateral proximal PE. RV dilatation
- In the ED, he is sitting in bed, requiring supplemental oxygen
- Vitals (ED): RR-24/min, HR-120 bpm, BP-100/60 mmHg
- Bedside TTE: Dilated and hypokinetic RV with preserved apex. Estimated PA pressure 50 mmHg.

Case Cont’d – He is found to have:

Which of these would you choose for this Patient?

A. Anticoagulation with UFH (in anticipation for a procedure)
B. Anticoagulation with LMWH
C. Anticoagulation with a DOAC
D. IV half-dose lytics
E. IV full-dose lytics
F. Catheter directed lytics
G. IVC filter

Markers of PE-Related Mortality are Known

But Predicting / Preventing Decompensation is Harder

Konstantinides et al. JACC. 2016; 67(8): 976-990
PEITHO; IV Lysis in Submassive PE: Advantage driven by reduced hemodynamic collapse

More bleeding with IV thrombolysis

ULTIMA: Quicker Resolution of RV Dysfunction: Indirect Evidence of Efficacy

ULTIMA: Complications

- No major bleeding
- 4 minor bleeding:
  - 3 patients in the USAT group (10%): Transient hemoptysis, access site groin hematoma
  - 1 patient in the heparin group (3%): Muscular hematoma

SEATTLE II: Single Arm CDT for Submassive PE: Positive Effect on Surrogate Markers. More Bleeds

OPTALYSE PE: Can Less Lytic be Effective?
OPTALYSE PE: Less Lytic Effective (on Surrogate Markers). But ICH Possible


Meta-Analysis: Mortality Benefit for Lytics in Sub-Massive PE. Know the #'s

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

And in the Right Patients Advanced Therapy may Result in Benefit


But How do we Choose to Implement Advanced Therapies and which ones?

Anticoagulation
IV Thrombolysis
Catheter Directed Thrombolysis
Pharmaco-Mechanical Catheter Treatment
ECMO

Is PERT the Solution?

Jaber et al. JACC. 2016; 67(8): 991-1002
European Heart Journal, ehr405, https://doi.org/10.1093/eurheartj/ehz405. Published: 31 August 2019

Modern PE Care Results in Increased Resource Utilization

https://doi.org/10.1007/s11239-018-1737-8. [Epub ahead of print]
...but Less Convincing Outcome Improvement

Let’s Try and Implement...

Is Mr. Anderson a Hemodynamically Unstable Patient?
- 64 years old
- 3 days of progressive shortness of breath
- Morning of admission chest pain and “hunger for air”
- In the ED:
  - HR 110 at rest
  - O2 Sat 92% on NC
  - BP 100/60
- PMHx: Hypertension
- Home medications: Lisinopril, HCTZ and ASA

Is Mr. Anderson Unstable? – Cont’d
- Echocardiogram –
  - Dilated RV
  - Mild RV dysfunction
  - PA pressure estimated at 50 mmHg
- CT PE – Multiple segmental PE

Is Ms. McDonald Hemodynamically Unstable?
- 64 years old
- Previously healthy
- While walking off a plane collapsed
- Eye witnesses note spontaneous recovery within 1 minute
- Now in the ED:
  - HR 110 at rest
  - O2 Sat 99% on NC
  - BP 100/60
- Normal echocardiogram
- CT PE – Saddle PE

Should Mr. Morpheus Receive IV Lysis or CDT?
- 64 years old
- Presented with chest pain and shortness of breath
- Currently in the ED:
  - HR 110 at rest
  - O2 Sat 89% on NC
  - BP 70/40
- Bilateral main PA PE
Can ECMO Help Mr. Jones?

- 64 years old
- Presented with chest pain and shortness of breath
- Collapsed in the ED
- Cannot receive IV Lysis because has known brain AVM
- Vital signs:
  - HR 110 at rest
  - O2 Sat 87% on NC
  - BP 60/
- Bilateral main PA PE
- Planned rescue surgical embolectomy

Take Home Messages

- Pulmonary emboli are heterogeneous
- Prognosis is determined by hemodynamic presentation
- Massive PE mandate aggressive and rapid treatment
- In submassive PE, little data suggest that aggressive treatment changes long-term outcomes
- For many patients with submassive PE an approach of watchful waiting (in an ICU) is reasonable and safe
- Aggressive treatment in submassive PE should be used judiciously, likely for patients who fail conservative therapy

Mortality in Patients Treated for Pulmonary Embolism

The hospital course of 144 consecutive patients with pulmonary embolism (PE) demonstrates that postoperative mortality was related to the initial mortality of patients with isolated PE. Various patients (5.6%) died at the initial hospitalization, and PE contributed to the death of eight other patients, each of whom had associated potentially lethal disease. The hospital mortality of these patients was 14.4%. Mortality in patients who survived longer than 3 days was 5.9%. The overall mortality of all patients was 10.9%. The mortality rate of patients with PE who survived longer than 3 days was 1.6%.


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