Management of Massive and Sub-Massive Pulmonary Embolism

M. Montero-Baker, MD
L Leon Jr., MD, RVT, FACS

Tucson Medical Center
Vascular and Endovascular Surgery Section
CASE PRESENTATION

54 YEAR-OLD CAUCASIAN FEMALE
OTHERWISE HEALTHY
CASE PRESENTATION

10 DAYS PRIOR – PNA, TREATED AT OUTSIDE ED HOSPITAL AS OUTPATIENT

AIR FLIGHT TO DALLAS FOR EASTER (2.5 HOURS)
CASE PRESENTATION

HUSBAND FOUND HER DOWN AT HOME
CPR FOR 5-10 MINUTES
EMS – CONTINUED CPR FOR TOTAL OF 30 MINUTES
BED CONTROL REPORT FOR TMC ER PATIENTS:

Admit MD: Dr. Hafi
Level of Care (Intensive, Intermediate, or General): Intensive
Diagnosis: S/P Cardiac arrest
Tele: yes
Isolation: no
Sitter: no
Dialysis: no
Special Needs: intubated

Electronically Signed by Kaiser, Margarett Turner RN on 4/9/2014 7:50 AM
CASE PRESENTATION

INTUBATED ON ARRIVAL
3 DOSES OF EPINEPHRINE AND ONE OF BICARBONATE
REGAINED VITAL SIGNS
CASE PRESENTATION

PER LAST REPORT, PATIENT WAS MOVING ALL EXTREMITIES, COMBATIVE, PRIOR TO INTUBATION
Risk stratification for acute PE

**Minor PE**
- 55% PE population
- Good prognosis
- Low mortality rate

**Massive PE**
- 5% PE population
- Sustained hypotension
- Inotropic support
- 58% mortality @ 3 mo

**Submassive PE**
- 40% PE population
- Systemic normotension
- RV dysfunction
- 22% mortality @ 3 mo

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Quiroz et al. Circulation (2004);109;2401-2404
Frémon, Chest 2008; 133;558-362
Schoef, Circ 2004; 110:3276-3280
Kucher, Arch Intern Med 2005; 165:1777-1781
CASE PRESENTATION

VASCULAR CONSULT
IMMEDIATE PULMONARY
THROMBOLYSIS
Flow studies explain why lytic infusion via catheter placed proximal to embolus may have no more effect than IV infusion

⇒ Local fluid dynamics evaluation demonstrates washout effect into the nonoccluded pulmonary artery when the catheter is positioned adjacent (NOT INSIDE) the embolus

⇒ Results support practice of intrathrombotic injection of lytic

IDENTICAL PROCEDURE FOR THE CONTRALATERAL PULMONARY ARTERY
Ultrasound accelerated thrombolysis
Ultrasound accelerated thrombolysis

**Fibrin Separation**
Non-Cavitational US Separates Fibrin without Fragmentation Emboli

**Active Drug Delivery**
Drug is actively driven into clot by “Acoustic Streaming”

Fibrin without Ultrasound

Fibrin With Ultrasound

Acoustic Streaming Drives Lytic into clot
CASE PRESENTATION

CONTRAST USED: 2 CC
FLUOROSCOPY TIME: 13.3 MINUTES
INFUSION TIME: 48 HOURS
THROMBOLYTIC DOSE: 58 MG tPA
ICU STAY APRIL 9-15 (6 DAYS)
CASE PRESENTATION

HOSPITAL STAY APRIL 9-21 (12 DAYS)
DISCHARGED TO HOME ON COUMADIN
DEAD from PE ON APRIL 9, 2014
DEAD from PE ON APRIL 9, 2014

EKOS THROMBOLYSIS
DEAD from PE ON APRIL 9, 2014

EKOS THROMBOLYSIS

DISCHARGED ON APRIL 21, 2014
DEAD from PE ON APRIL 9, 2014
EKOS THROMBOLYSIS
DISCHARGED ON APRIL 21, 2014
CLINIC FOLLOW-UP JUNE 4, 2014 (56 days after her death)
An echocardiographic RV/LV ratio $> 0.9$ was shown to be an independent predictive factor for hospital mortality.

Fremont B, Pacouret G, Jacobi D. CHEST 2008;133:358-362
An echocardiographic RV/LV ratio > 0.9 was shown to be an independent predictive factor for hospital mortality.

Fremont B, Pacouret G, Jacobi D. CHEST 2008;133:358-362

Mortality rate:

- 1.9% if RV/LV ratio < 0.9
- 6.6% if RV/LV ratio ≥ 0.9
PE patients with **Right Ventricle Dysfunction (RVD)** unresolved prior to discharge suffered more than **4-times** the mortality rate than patients whose RVD was resolved.


**Association of Persistent Right Ventricle Dysfunction at Hospital Discharge After Acute Pulmonary Embolism With Recurrent Thromboembolic Events**

**Background:** In patients with acute pulmonary embolism, right ventricular dysfunction (RVD) on hospital admission is a predictor of adverse short-term clinical outcome. The aim of this study was to evaluate the prognostic value of RVD persistence at hospital discharge with regard to the likelihood of recurrent venous thromboembolism (VTE).

**Methods:** Echocardiography was used to assess RVD on admission and before hospital discharge in 301 consecutive patients with the first episode of acute pulmonary embolism. The patients were categorized as those (1) without RVD (155 patients [51.5%]), (2) with RVD regression (RVD on admission but not at discharge; 87 patients [28.9%]), and (3) with persistent RVD (RVD on admission and at discharge; 59 patients [19.6%]). After a mean ± SD of 3.1 ± 2.7 years, patients with RVD persistence showed an increased risk of recurrent VTE (14 patients, 9.2% patient-years) compared with those without RVD (15 patients, 3.1% patient-years) or RVD regression (3 patients, 1.1% patient-years) (P = .001). Six of 8 deaths related to pulmonary embolism occurred in patients with RVD persistence. At multivariate analysis, adjusted by anticoagulant treatment...
PE patients with **Right Ventricle Dysfunction (RVD)** unresolved prior to discharge suffered more than 4-times the mortality rate than patients whose RVD was resolved.


**Mortality rate at 4 years:**

- 10.2% if RVD unresolved at discharge
- 2.3% if RVD resolved at discharge
Systemic Thrombolysis for massive PE

- 100 mg rt-PA infused over 2 hours
- Indication: treatment of (massive) patients presenting with acute PE and:
  1. Syncope,
  2. Systemic arterial hypotension,
  3. Cardiogenic shock, or
  4. Cardiac arrest
Elevated risk of bleeding complications associated with systemic thrombolysis

Pooled Results of Published Outcomes From Placebo-Controlled, Randomized Trials of Fibrinolytics to Treat Acute PE
(Jaff et al. Circulation 2011;123;1788-1830)

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<thead>
<tr>
<th>Author/Study</th>
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<th>N Lytic</th>
<th>N Placebo</th>
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## Elevated risk of bleeding complications associated with systemic thrombolysis

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**Subtotal**

50.2% 49.8% 13.44% 5.98% 3.16% 3.59%

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**Grand total**

49.7% 50.3% 17.03% 5.73% 3.62% 3.58%

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### Intracranial Hemorrhage: Efficacy at the Cost of Safety

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<td><strong>ICOPER</strong></td>
<td>9/304 (3%)</td>
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<td><em>(Goldhaber SZ, et al. 1999)</em></td>
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<td><strong>PEITHO</strong></td>
<td>10/506 (2%)</td>
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In patients with acute PE associated with hypotension..., if appropriate expertise and resources are available, we suggest catheter-assisted thrombus removal over no such intervention (Grade 2C)

Fibrinolysis & catheter-based interventions

- are reasonable for patients with massive PE (Class IIa; Level of Evidence B and C)
- may be considered for submassive PE (Class IIb; Level of Evidence C)
ULTtrasound Accelerated Thrombolysis of Pulmonary Embolism with EKOS

- Design: Phase II, randomized, controlled, multi-center study
  ➢ (EKOS vs anti-coagulants)
- N=59: Tx: 30 EKOS; Control: 29 Standard of Care
- Entrance Criteria: Submassive PE
- Outcome Measures:
  ➢ Primary Efficacy: Reduction in right heart dysfunction at 24 hrs
  ➢ Primary Safety: Mortality, bleeding, recurrent PE, deterioration into cardiogenic shock
US-accelerated lysis achieved greater RVD resolution compared to heparin.
Conclusions

• Ultrasound-facilitated catheter-directed low-dose fibrinolysis for acute PE improves RV function and decreases pulmonary hypertension and angiographic obstruction

• By minimizing the risk of intracranial bleed, ultrasound-facilitated catheter-directed low-dose fibrinolysis represents a potential “game-changer” in treatment of high-risk PE patients
Tucson, Arizona

THANK YOU FOR YOUR ATTENTION