“PERT”: Pulmonary Embolism Response Team

Robert M Schainfeld, DO, FSCAI
Associate Director, Vascular Medicine
Fireman Vascular Center
Massachusetts General Hospital
Boston, MA
I, Robert Schainfeld, DO NOT 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.
Williams Was Treated for Blood Clot in Lungs

By CHRISTOPHER CLAREY
Published: March 2, 2011

Serena Williams, out of action since winning Wimbledon in July, has experienced another significant health problem that could further delay her return to the game she once dominated. Williams’s representatives confirmed Wednesday that she was hospitalized last month in Los Angeles because of a pulmonary embolism and that she then required emergency treatment Monday for a hematoma, a pocket of blood that swells under the skin.

A pulmonary embolism — a clot that blocks blood flow to the lungs — can be life threatening in severe cases, but Williams’s spokeswoman, Nicole Chabat, said in a statement Wednesday that “thankfully everything was caught in time” and that Williams was resting and recovering at her home in Los Angeles.

“This has been extremely hard, scary, and disappointing,” Williams said in a statement. “I am doing better. I’m at home now and working with my doctors to keep everything under control. I know I will be O.K., but am praying and hoping this will all be behind me soon. While I can’t make
Zsa Zsa Gabor hospitalized for blood clot

LOS ANGELES – A spokesman for actress Zsa Zsa Gabor says the actress has been admitted to a Los Angeles hospital for treatment of painful swelling in her legs.

John Blanchette says Gabor was admitted to Ronald Reagan UCLA Hospital earlier today after a doctor visited her at home, and said she had massive blood clots in her legs, which could make her vulnerable to a heart attack.

The 93-year-old Gabor has been hospitalized several times this year, and asked for a priest to read her last rites in August.

Since summer, Gabor has undergone surgery to remove clots from her upper body and has had a hip replacement surgery.

Follow Yahoo! News on Twitter, become a fan on Facebook
PE: Clinical Presentation

Non Massive
Low Risk
NL RV & Biomarkers

Submassive
Intermediate Risk
+/- RV dysfunction
+/- Biomarkers

Massive
High Risk
Therapeutic Alternatives in Acute Venous Thromboembolism

- **Anticoagulation**
  - Unfractionated Heparin
    - Continuous Intravenous
    - Full-Dose Subcutaneous
  - Low-Molecular-Weight Heparin
  - Direct Thrombin Inhibitors
  - Factor Xa inhibitors
  - Synthetic Pentasaccharide Xa Antagonist
  - Warfarin

- **Thrombolytic Therapy**
  - Catheter-Directed
  - Systemic

- **Mechanical**
  - Vena Caval Filter
  - Surgical Thrombectomy
  - Thromboaspiration
  - Endovascular Pharmacomechanical Catheter-Directed Thrombolysis (PCDT)
  - Extracorporeal support
Guidance in the Literature for Treatment of Massive Submassive PE: Very Little
Submassive PE Therapy

Procedure:

1. **Evidence of Shock or Respiratory Failure:**
   - Any hypotension (SBP < 90 mm Hg)
   - Shock index > 1.0
   - Respiratory distress (SaO2 < 95% with Borg score > 8, or altered mental status, or appearance of suffering)

2. **Evidence of Moderate to Severe RV Strain:**
   - RV dysfunction (RV hypokinesis or estimated RVSP > 40 mm Hg)
   - Clearly elevated biomarker values (e.g., troponin above borderline value, BNP > 100 pg/mL or pro-BNP > 900 pg/mL)

   If no contraindications to fibrinolysis:

   **Alteplase**
   - 100 mg over 2 h IV
Thrombolysis for PE: The Controversy Continues

Recent Trials

Full dose systemic lysis:
- PEITHO
- TOPCOAT

Reduced dose lysis:
- MOPPET: half dose systemic lysis
- ULTIMA, SEATTLE II:
  Ultrasound - enhanced lysis
Pulmonary Embolism: Which therapy to use?

• Best treatment unknown – no “standard approach”
• MGH example - strategies “all over the map”
  – Varies by medical service, location, size and threat to patient, yadi yadi yada
  – No consistency in decision - making
  – No single “team” or “clearing-house”
  – No accepted algorithm
  – No centralized location for care
  – No systematic evaluation of results
Pulmonary Embolism Response Team (PERT)

A Multidisciplinary Effort to Improve Care and Outcomes in Patients with PE
Case #1

- 76 yo female with sickle cell
- PE in 2012 post-op spinal surgery
- recent colitis → Coumadin stopped
- 3 days PTA, acute onset SOB, lightheaded
- OSH ER: SBP 80/40, tachypneic @ 32
- SaO2 = 90% on non-rebreather
“iPhone Data”

What would you do next?
Who makes the decision and how?
Case #2

• 37 M s/p knee surgery
• After a bowel movement felt dizzy, short of breath and a feeling of impending doom
• EMS brought him to ED. SBP 80-90s, SaO2 80% on RA
• Resuscitated with fluid and oxygen
• CT→ large PE with clot in-transit → Transferred to MGH
Pulmonary Embolism – previous paradigm

...\textit{Chaos}
PERT: Pulmonary Embolism Response Team

- **Mission**: Improve patient outcomes with a collaborative, multidisciplinary team-based urgent consult to treat massive and submassive PE

- **Functionality**
  - Modeled on rapid - response concept
  - Multidisciplinary team of experts: convened via electronic meeting
  - Evaluate and offer full range of available treatment options

_Chest 2013;144:1738_
Objectives

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

MGH Unit

Referring Hospital

Severe PE Identified

PERT Team Activated

Immediate Conference with:
ED/Floor Team
Pulmonary
Vascular Medicine/Cardiology
Thoracic Surgery

Disposition and Treatment Plan
One telephone number
Answered 24/7 by the MASCO answering service

- Prescribed protocol
- Fellow receives page that includes a pre-defined set of relevant information
- Administrator simultaneously receives the same information via email
PERT Program Flow Map

Expeditious input and clinical judgment from multiple specialties to optimize therapy

ED

MGH floor

OSH

PERT fellow:
History
Physical Labs
EKG
Echo
CT-PE

Low Risk

Submassive

Massive

ACTIVATE PERT MULTIDISCIPLINARY TEAM

Electronic Meeting
Vascular Medicine
Cardiac Surgery
ICU/Pulmonary
Hematology
Rad,Echo

Handoff to therapeutic site

A/C

Lytic

CDT

Vortex

ECMO

Surgery
MGH PERT Participants (partial list)

**Attending Physicians**
Vanessa Bradford Kerry, MD
Richard N. Channick, MD
Douglas E. Drachman, MD
Suvrani Ganguli, MD
Joseph M. Garasic, MD
Jose Perez Garcia, MD
Brian Ghoshhajra, MD
Michael R. Jaff, DO
Christopher Kabrhel, MD
Thomas E. MacGillivray, MD
Serguei Melnitchouk, MD
Josanna Rodriguez-Lopez, MD
Kenneth Rosenfield, MD
Rachel P. Rosovsky, MD
Robert Schainfeld, DO
Thoralf M. Sundt, MD
George Tollis
Gus J. Vlahakas, MD
Jennifer D. Walker, MD
Ido Weinberg, MD

**Graduate Assistants and Fellows**
Farhad Abtahian, MD, PhD
David M. Dudzinski, MD
Jessica Mintz, MD
Bharat Samy, MD
Stephen Waldo, MD
Alison S. Witkin, MD

**Nurses**
H. Thomas Blanchard, RN
Maryfran Hughes, RN
Joyce A. McIntyre, RN
Sharon McKenna, RN
Maureen E. Schnider, RN

**Research & Administration**
Ryan T. Callaghan
Edward Chu, MD
Daniel Corrigan, MD
Michael Genuardi, MD
Praveen Hariharan
Savanah Harshbarger
Phillip Kim
Renee A. Langton
Donna Lawson, RN
Michael Lu, MD
Janet M. McClintic
Marilyn A. McMahon
Blair A. Parry
Nosheen Reza, MD

A Teaching Affiliate of Harvard Medical School
Back to our patient #1
76 y.o. female with Sickle Cell; “clot in transit”

RV dilated & akinetic
PERT Team Activation

- Medflight from OSH to MICU → CT and Vascular Medicine evaluation
  - BP marginal on pressors
  - NT - BNP >12k, Trop T - 0.14
  - RV dilated / hypokinetic

Multidisciplinary PERT activation & discussion →
Vascular Medicine, Pulmonary Critical Care, CT Surgery, Hematology, ED, Radiology
TEE - Guided Thromboaspiration

Pre

Post
Course Post - Thromboaspiration

- Transferred to MICU
- **PEA arrest → CPR**
- Urgent transfer back to cath lab
- Placement of bilateral EKOS catheters for CDT
- t-PA bolus, then 1mg/hr
MICU Course

- Oxygenation markedly improved (FiO2 100% → 40%) over 12 - 24 hrs
- Pressors weaned over 24 hrs
- Improved RV function
- Extubated on Day 5; home after 2 weeks

Seen in office @ 2 years—living independently at home and no SOB
Expired @ three years from unrelated issue
Case #2 - 37 y.o. man post-op knee surgery with “clot in transit”
PERT Activation

- At time of initial assessment:
  - Relatively comfortable, however –
  - Moderately tachypneic
  - Chest pressure
  - Right shoulder pain

- PLANS MADE FOR Angiovac (VORTEX)

Precipitous decompensation in ED!!!
“Crashed” onto ECMO

- Right femoral vein (25 F)
- Left femoral artery return (17-19F)
- Antegrade Left SFA distal perfusion

Concept of ECMO as “bridge” to definitive therapy
Intraoperative Photo
Embolic Material – Surgeon’s Appetizer du jour

Right atrium

Left PA

Right PA
“Perfect Desert Storm”
EKOS Catheter in Left PA
PERT Data

- Total activations: 294
  - Activations by hospital location
    - ED: 60%
    - ICUs: 19%
    - Floors: 21%
  - Off - hours/weekends/holidays: 61%

- Multidisciplinary virtual consults: 128 (53% of valid activations)
  - Median time to virtual consult: 104 mins
  - Number of participants: 8 – 15 physicians
  - Average length of consult: 25 mins
- Male: 57%  Female: 43%
- Age range: 10 – 98 yrs  Median age: 62 yrs
- Survival to discharge: 84%
- Interventions:
  - 58.7%  Anticoagulation only
  - 8.7%  Catheter-direct thrombolysis
  - 4.8%  Surgery
  - 2.8%  IV systemic lysis
  - 2.8%  Mechanical support/ECMO
  - 21.8%  IVC filters
  - 0.4%  Vortex
PERT - Next Steps

- Refinement of PERT at MGH
  - Standardize protocols, Education, Research
  - Regionalize PERT (MGH as “center of excellence”)
- Consortium development
  - Mission and Vision, structure, governance, bylaws
  - Funding
    - For infrastructure/logistical support & research
  - Member recruitment
- “Kick-off” meeting (May, 2015)
  - Associated didactic mini-symposium
Operational Approach

The Massachusetts General Hospital Pulmonary Embolism Response Team (MGH PERT):
Creation of a Multidisciplinary Program to Improve Care of Patients With Massive and Submassive Pulmonary Embolism.


Table 2. Suggested Hospital Stratification by Availability of PERT Faculty, Resources, and Specialists

| PERT Level 1:  | Vascular medicine and cardiac interventional (catheterization laboratory) services |
|               | Cardiac surgery services |
|               | Transesophageal echocardiography services |
|               | Medical and surgical ICUs staffed 24/7 by intensivists |

| PERT Level 2: Non-emergent | Vascular medicine and cardiac interventional services |
|                           | Cardiac surgery services |
|                           | Transesophageal echocardiography services |
|                           | Medical and surgical intensive care units |

| PERT Level 3: Lacking either cardiac interventional, cardiothoracic surgery, echocardiography, or ICU services |
Case 29-2014: A 60-Year-Old Woman with Syncope

Given the complex decision making required in the treatment of this patient, we activated a multidisciplinary rapid-response team, the pulmonary embolism response team (PERT), comprising experts in cardiology, emergency medicine, critical care, and vascular medicine. The team provides coordinated, real-time consultation with the use of online meeting software. When the timing is critical, the ability to rapidly decide on a treatment plan and mobilize the necessary resources to enact that plan is extremely helpful.
Invited Presentations

- Case Western Reserve University
- Dartmouth Hitchcock
- Washington University, St. Louis
- Bart’s Health, London
- Brigham and Women’s Hospital
- American Thoracic Society
- Society for Thrombosis and Haemostasis
- American Heart Association
- VEITH Symposium
- CHEST National Meeting
- American College of Cardiology
- VIVA
- Local Meetings and Grand Rounds
Current and Future Research Projects
Examples

• **How does PERT affect Treatment and Outcomes?**
  – Quasi-experimental (interrupted time series) study of matched patients with severe PE before and after the initiation of the PERT Program, to determine whether PERT changes treatment and outcomes.

• **Do multidisciplinary meetings affect decision making?**
  – Survey of clinicians at time of and after PERT activation to determine how decision making, and comfort with treatment decision, changes after multidisciplinary consultation.

• **What is the incidence of CTEPH in patients with high-risk PE?**
  – Analysis of PERT patients to determine the incidence of CTEPH at one year in patients treated for massive or submassive PE, controlling for treatment and comorbidities.

• **When should patients with high-risk PE be screened for CTEPH?**
  – Comparative study of timing and choice of diagnostic tests for CTEPH in survivors of massive and submassive PE.

• **Does dual energy CT pulmonary angiography aid in the risk stratification of high-risk PE?**
  – Comparison of standard CT, dual energy CT and echocardiography in the prognosis of PE, controlling for treatment and co-morbid illness.
PERT Consortium

19+ Interested Centers
Inaugural Meeting – May 2015
• Summary
  – New era: heightened awareness and coordinated institutional approach to a complex, life-threatening problem
  – PERT: a “model” program, demonstrating the power of interdisciplinary collaboration to streamline care, optimize outcomes for our patients, and enable development of better treatment paradigms for patients with PE
Mass AAU State Champions U -13