Is PE the New STEMI??

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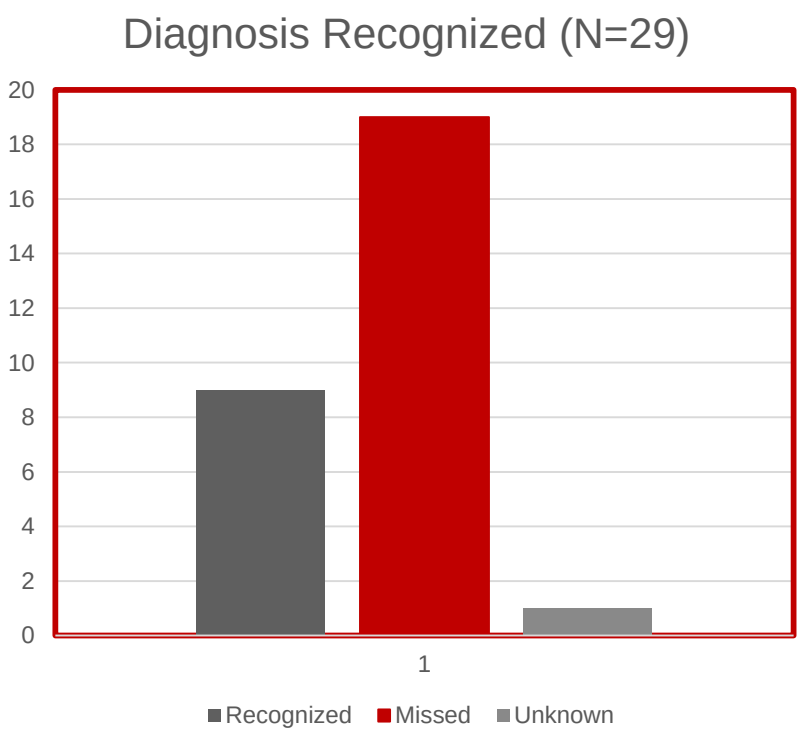
PE Incidence / Mortality

- Third most common CV disease after CAD and Stroke
- Incidence estimated at 60-70 per 100,000
- Significant mortality (~30%) if untreated
- Improved mortality (~8%) if treated
- Most prevalent in older population (> 60yo)
- Sudden death occurs in 10% of cases (*second leading cause after cardiac)*
- **2/3** patients who die succumb < **2** hrs of presentation

Bělohlávek, J., Dytrych, V., & Linhart, A. (2013). Pulmonary embolism, part I: Epidemiology, risk factors and risk stratification, pathophysiology, clinical presentation, diagnosis and nonthrombotic pulmonary embolism. *Experimental & Clinical Cardiology*, *18*(2), 129–138.

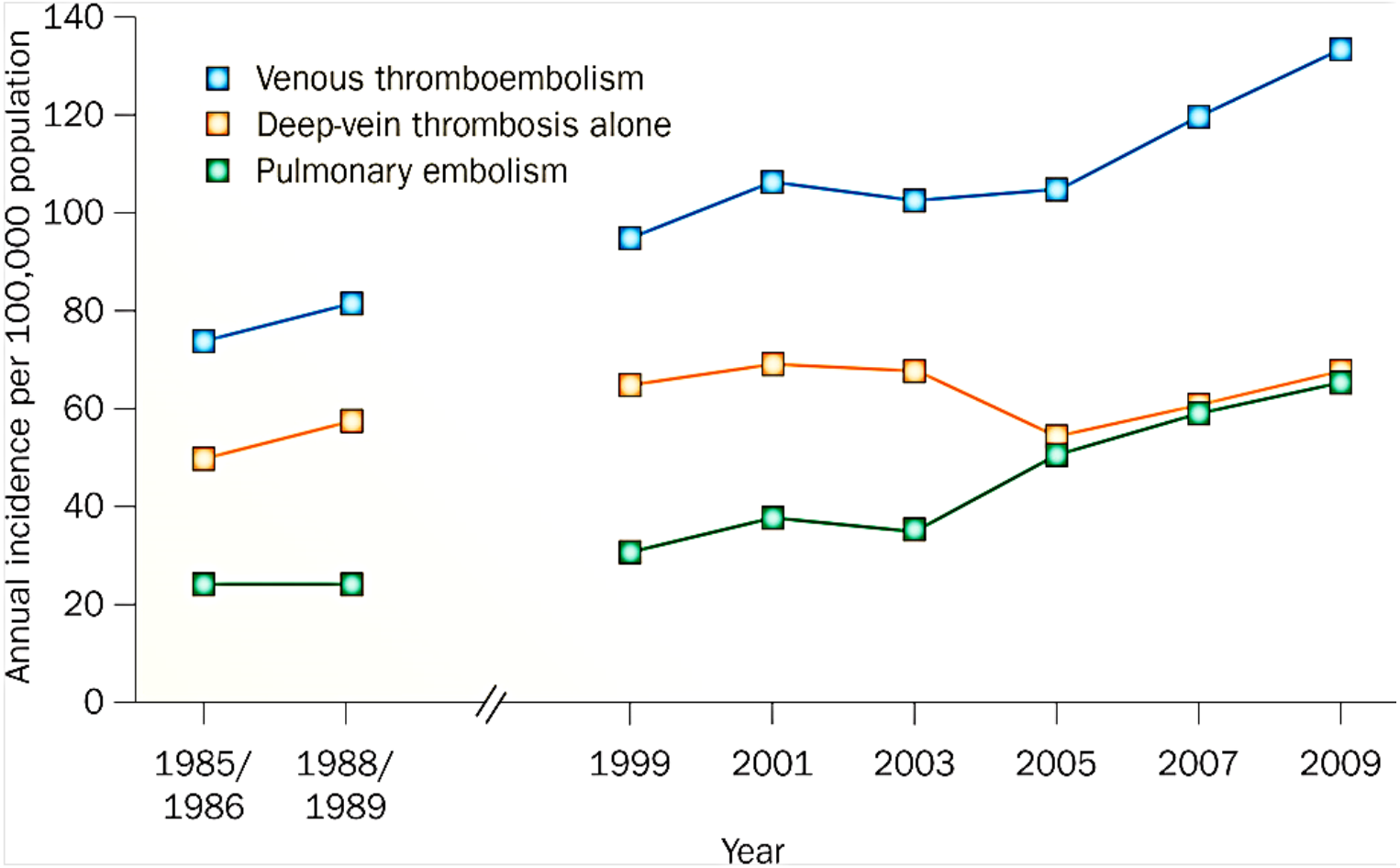
PE Diagnosis is Challenging



- 10 yr. retrospective study
- 982 Autopsies
- PE cause of death in108 (11%)
- 29/108 treatment eligible (27%)
- 9 cases, PE in differential Dx
- Only 3 received thrombolytics
- **66% PE diagnosis MISSED**

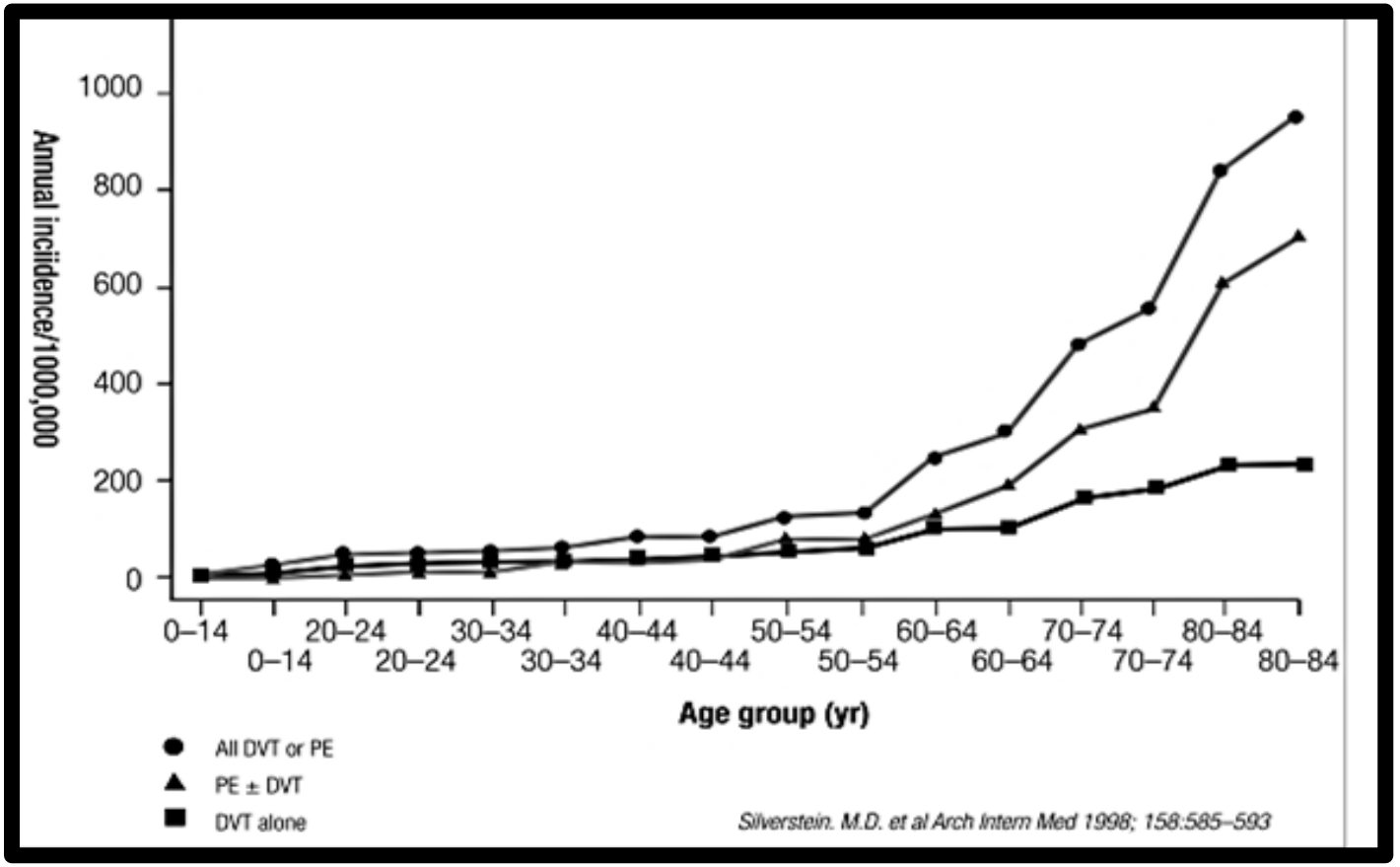
Sweet, P. H., Armstrong, T., Chen, J., Masliah, E., & Witucki, P. (2013). Fatal pulmonary embolism update: 10 years of autopsy experience at an academic medical center. *JRSM Short Reports*, *4*(9), 2042533313489824. http://doi.org/10.1177/2042533313489824

Incidence of PE



Heit, John A. (2015). Nat Reb Cardiol.: 12(8): 464-474. Cited from:
Huang, W. et al (2014), Secular trends in the occurrence of acute venous thromboembolism: the Worcester VTE study (1985-2009). Am J Med 127, 829-839

Incidence of PE by Age



Annual Incidence of DVT and PE among residents of Olmstead County MN from 1966-1990

Mortality by Clinical Presentation

Mortality rate of acute pulmonary embolism according to Czech (2) and European (3) Guidelines

Clinical presentation of acute pulmonary embolism	Mortality rate
Unselected population	11.4% at 2 weeks, 17.4% at 3 months
Massive pulmonary embolism	
Overall	18% to 65%
Treated	Approximately 20%
With cardiogenic shock	25% to 30%
With resuscitation	65%
Submassive pulmonary embolism	5% to 25%
Pulmonary embolism with mobile thrombi in right-heart chambers	As high as 27%
Small pulmonary embolism	Up to 1%

Bělohlávek, J., Dytrych, V., & Linhart, A. (2013). Pulmonary embolism, part I: Epidemiology, risk factors and risk stratification, pathophysiology, clinical presentation, diagnosis and nonthrombotic pulmonary embolism. *Experimental & Clinical Cardiology*, *18*(2), 129–138.

Overview of Risk Factors for PE

Inherited

- Thrombophilia
- Family History

Lifestyle

- Smoking
- Stress
- Diet/Obesity (BMI>30 = 2-3X risk)

Acquired

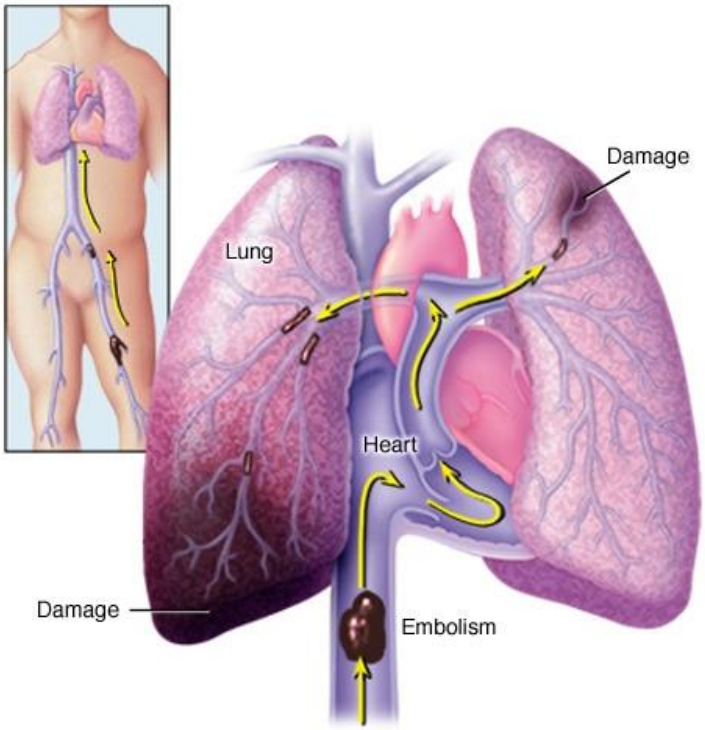
- Age
- Malignancy (cancer)
- Recent Surgery / Trauma
- Immobility
- Chronic Medical Illness
- Pregnancy / Post Partum
- Exposure to Steroids (estrogen/ BCP)

Inflammatory

- Acute and Chronic Infection
- Chronic inflammatory diseases

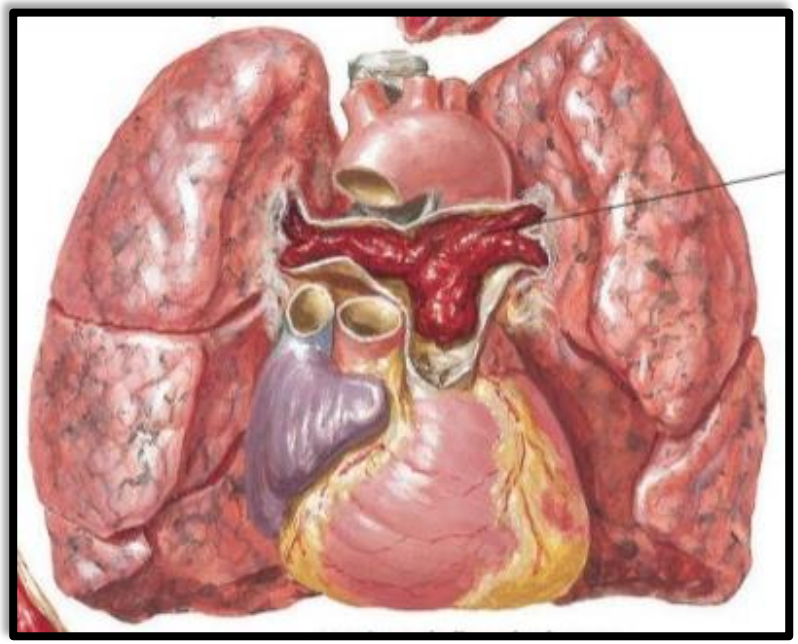
Mechanism/Clinical Presentation/Diagnosis

- Disrupts pulmonary blood flow, inhibits exchange of O2 and CO2
- Can lead to pulmonary HTN, RV failure, Pulmonary Infarct
- Sudden death by CV collapse: PEA or Asystolic Arrest
- Associated w/ DVT in 60-80% of cases (can also arise from iliac and renal veins, inferior vena cava, or R heart clots)
- Diagnosis mimics other disorders and can be challenging, especially in presence of comorbidities
- Assessment of risk factors and high index of suspicion is key



Effects are determined by size and location of the clot

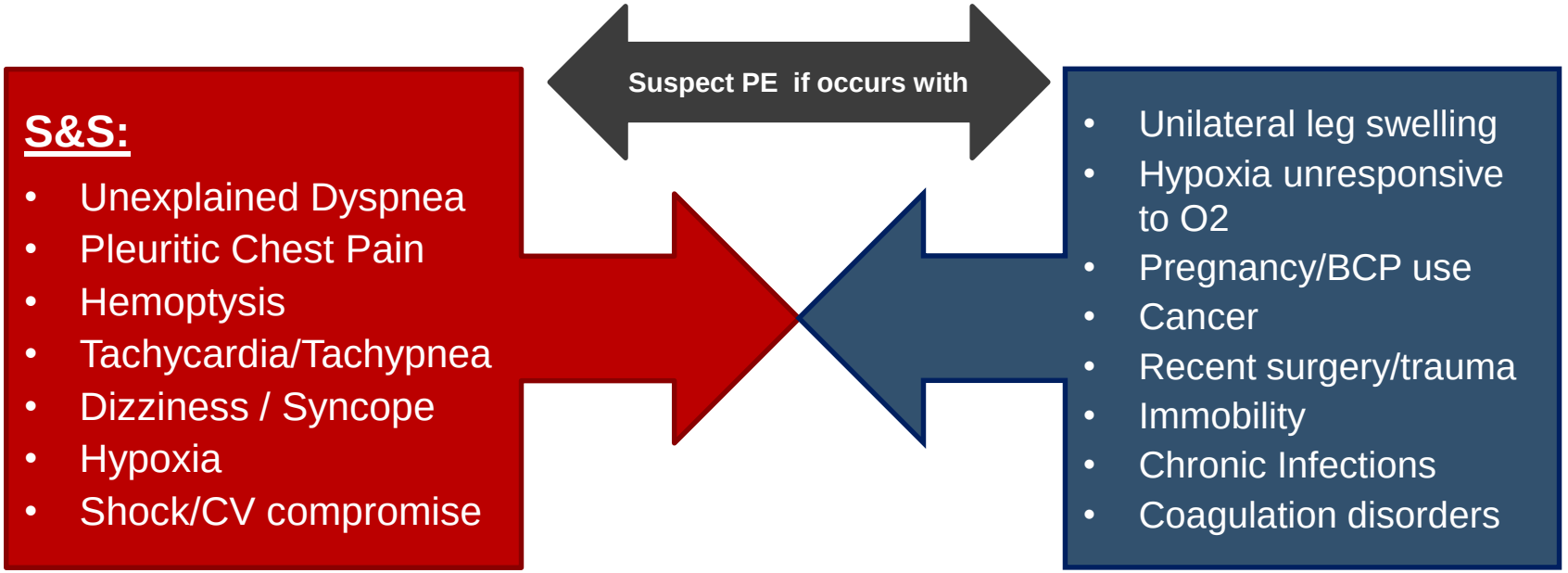
Severity Spectrum



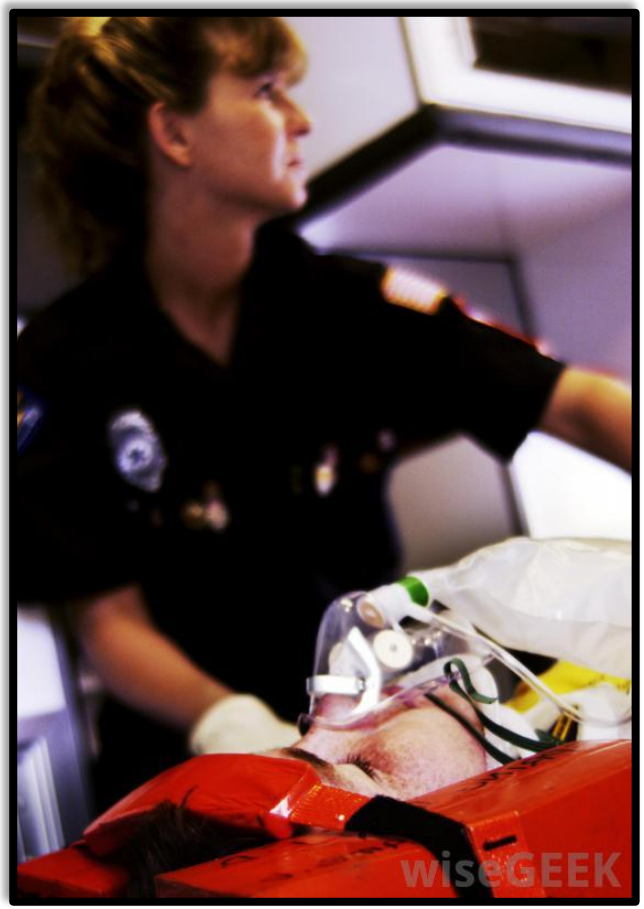
75%
Stable

10%
Sudden
Death

Effects are determined by size and location of the clot



Prehospital Treatment Priorities

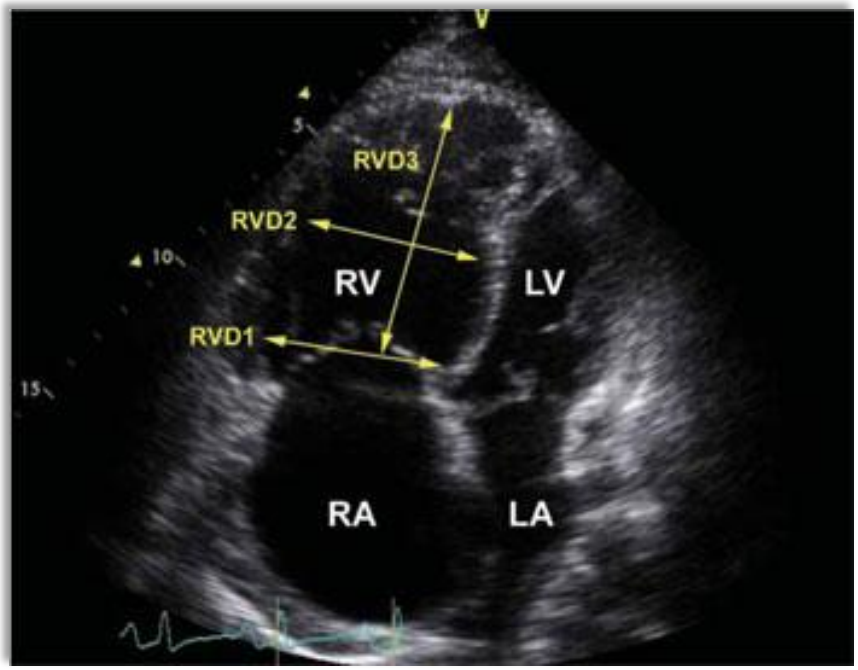


- Treatment driven by patient stability
- Early recognition and supportive measures
- Administer O2 to maintain SpO2 > 94
- CPAP may maximize O2 delivery
- Early IV access: Signs of shock (BP<90, tachycardia, pallor, mental status changes and/or syncope) are high mortality risk; Treat hypotension w/ initial fluid bolus, pressors if no response
- Early airway management / intubation if declining LOC and shock is present (add PEEP)
- Rapid transport to facility capable of comprehensive and timely PE intervention

In Hospital Diagnostics

- CTA: gold standard to confirm / exclude presence of clots in pulmonary bed

In Hospital Diagnostics



- **Echocardiogram:** main adjunct method to evaluate hemodynamic impact and stratify risk (identify RVS). Essential rapid evaluation in unstable patients unable to undergo CTA

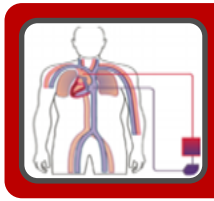
In Hospital Diagnostics

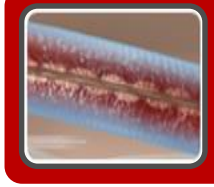
- CXR and EKG:
  Not diagnostic but signs can reinforce clinical suspicion

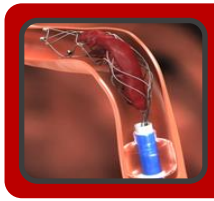
- Biomarkers (Troponin, BNP, D-Dimer): Non specific for PE; not reliable diagnostic tools but can stratify risk in known PE and reinforce clinical suspicion

Treatment Options


Systemic Thrombolysis


ECMO (bridge to other treatment options)

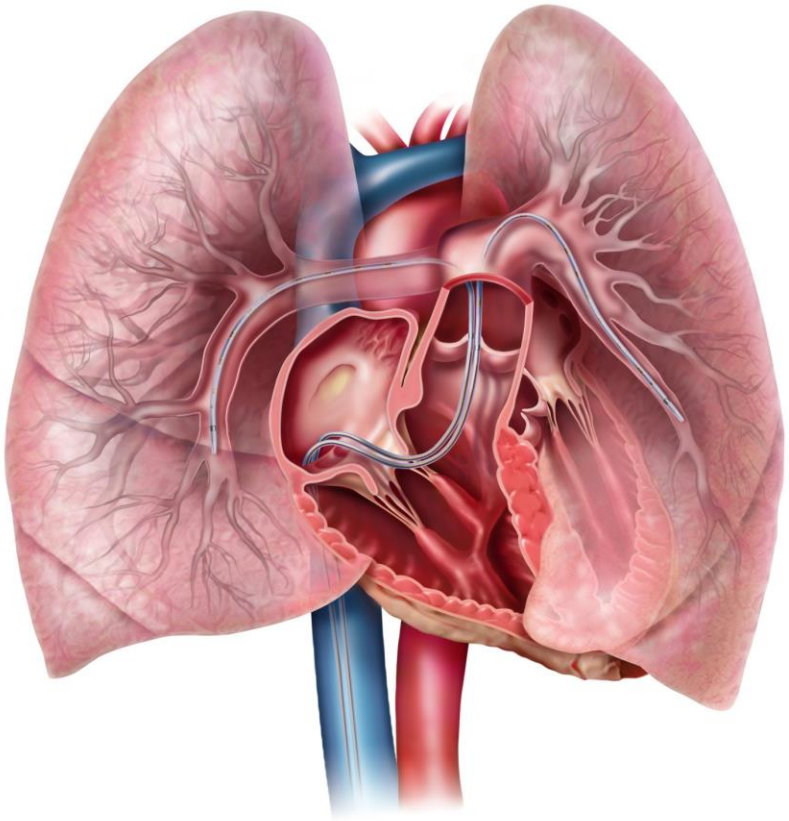

Catheter Directed Thrombolysis (EKOS)

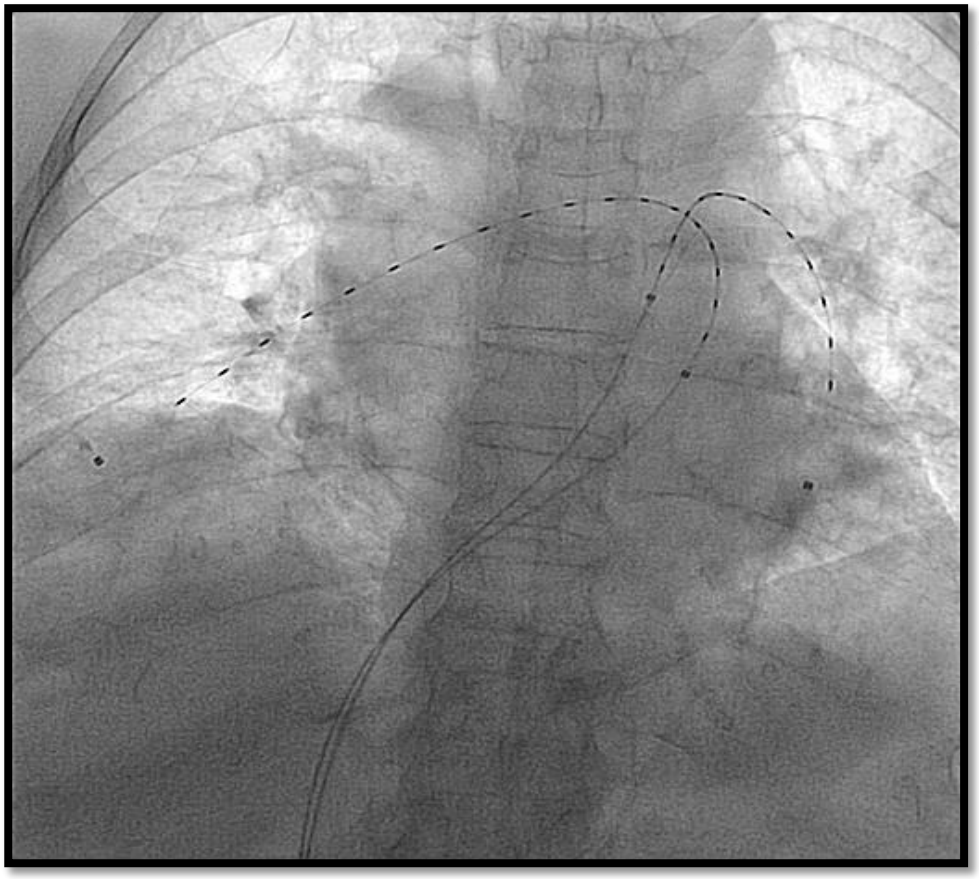

Catheter Based Thrombectomy


Surgical Thrombectomy

Anticoagulation Therapy

Catheter Directed Thrombolysis





The OSU Experience: PE Program

PE response was incorporated into OSU's Level One Heart and Vascular Emergencies Program in June 2013

Program Goals:

- Provide rapid access to consultation and transfer acceptance
- Quickly mobilize internal resources for rapid interdisciplinary collaboration and intervention

Pulmonary Embolism Response Teams* (PERT)

- Rapid in-hospital response to PE management
- Treatment decisions are guided by standardized evidence-based protocols, rapid activation of resources and interdisciplinary collaboration

OSU has an active PERT program
and is a
Founding Member of the National PERT Consortium

THE OHIO STATE UNIVERSITY
WEXNER MEDICAL CENTER

What is a Pulmonary Embolism Response Team (PERT)?

An institutionally based multidisciplinary team that:

- Facilitates timely decision-making, rapid assessment and appropriate treatment for acute PE
- Has a formal mechanism to exercise a **full range** of medical, surgical and/or endovascular therapies
- Provides appropriate multidisciplinary follow up of patients
- Improves interdisciplinary communication and collaboration
- Enables systematic collection and evaluation of data related to PE treatment and outcomes

PERT: Why should we do this?

- Interdisciplinary collaboration/team approach with a goal of streamlining care, optimizing outcomes, and developing better treatment paradigms for PE
- Provide a rapid response to treatment of massive and submassive PE
- Provide the best therapeutic options for each patient
- Coordinate care among services involved in PE management, including post hospital follow up care
- Develop protocols for the full range of available therapies
- Collect data on clinical presentation, treatment efficacy and outcomes (provide data for evidence based practice)

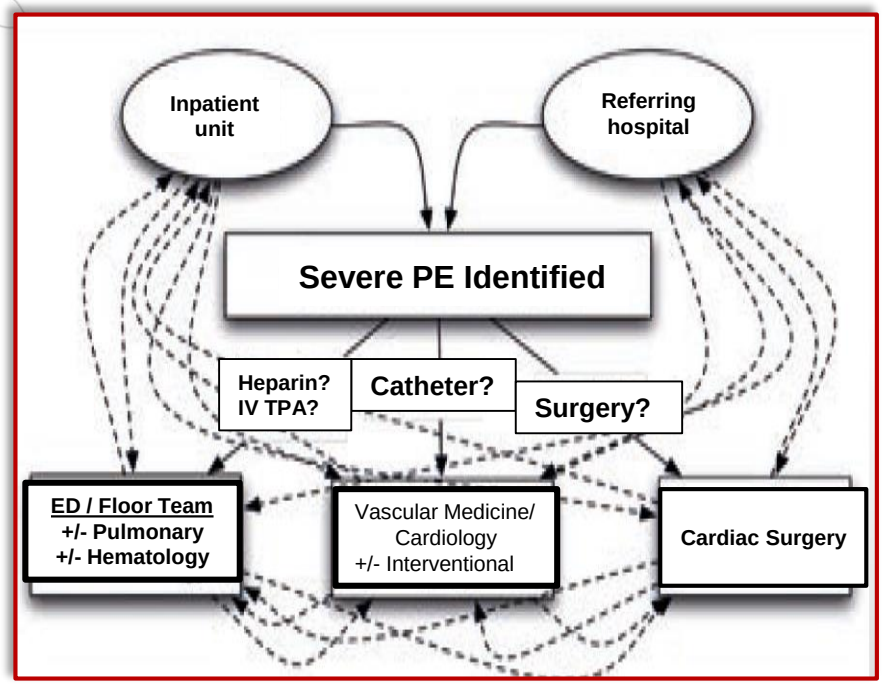
Proposal

Goal: Become a *Pulmonary Embolism Treatment Center of Excellence*

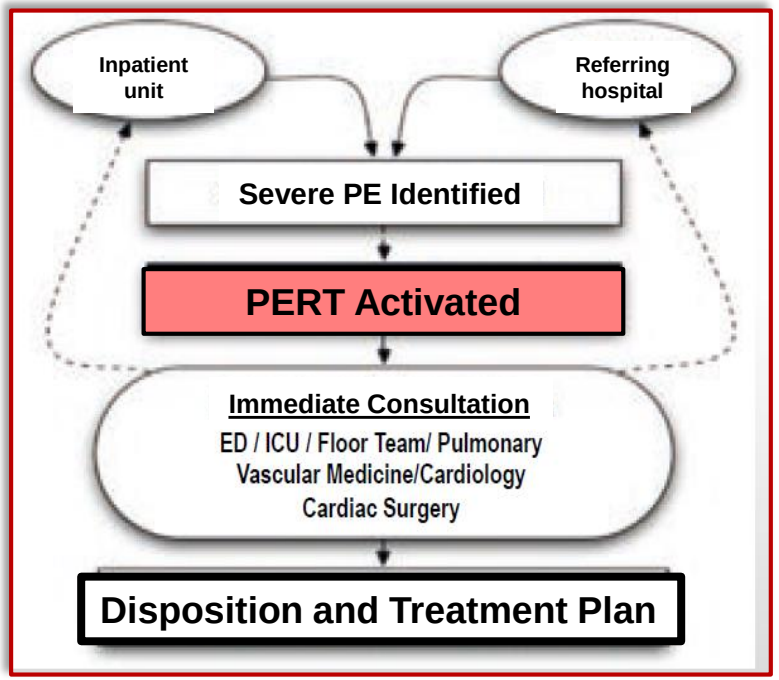
- Develop and implement a comprehensive, interdisciplinary PE management program which includes all levels of PE acuity throughout the medical center
- Implement a standard triage and treatment protocol for management of PE, including post-discharge follow up
- Join the national PERT Consortium as Founding Members
- Maintain a comprehensive PE database/registry to develop and monitor quality metrics and facilitate research

The Old vs. New Paradigms in PE management

Old: Chaos….



New:



PERT Objectives

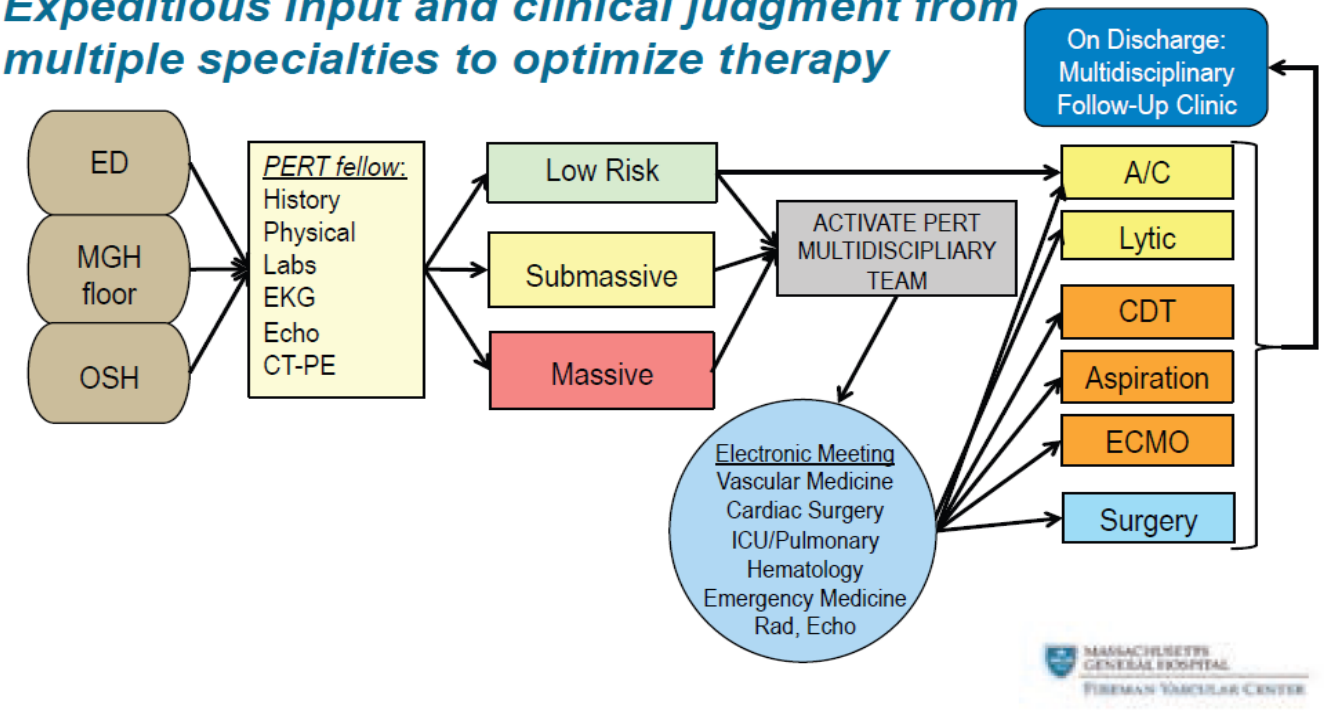
- Respond expeditiously to treat patients with massive and submassive PE
- Provide best therapeutic option(s) available for each patient
- Leverage input of a multidisciplinary team of experts
- Coordinate care among services involved in management of PE
- Develop protocols for the full range of therapies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

Fill the unmet clinical need and provide evidence base to close the gap in our knowledge base

The Concept of PERT

PERT Program Flow Map

Expeditious input and clinical judgment from multiple specialties to optimize therapy



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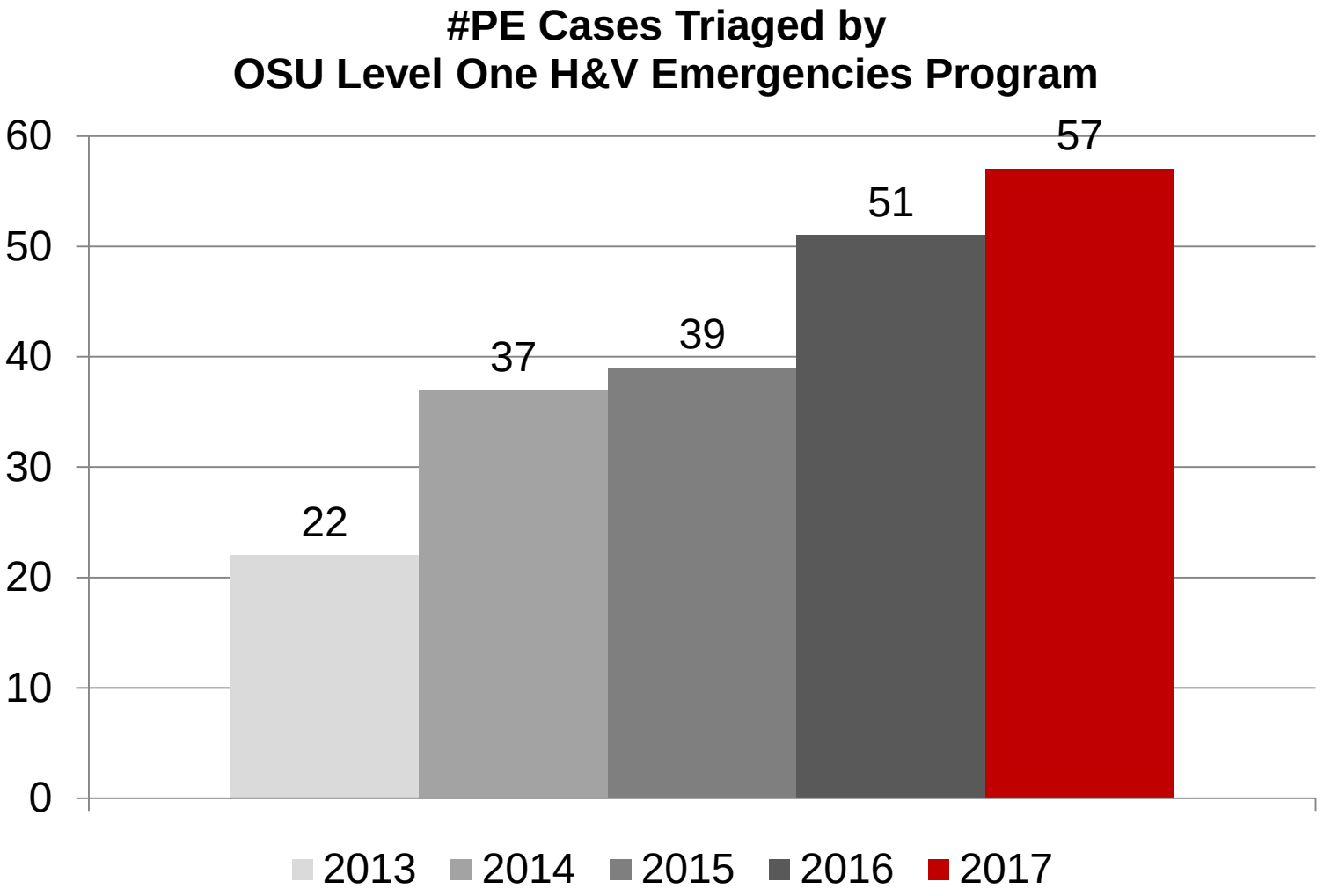
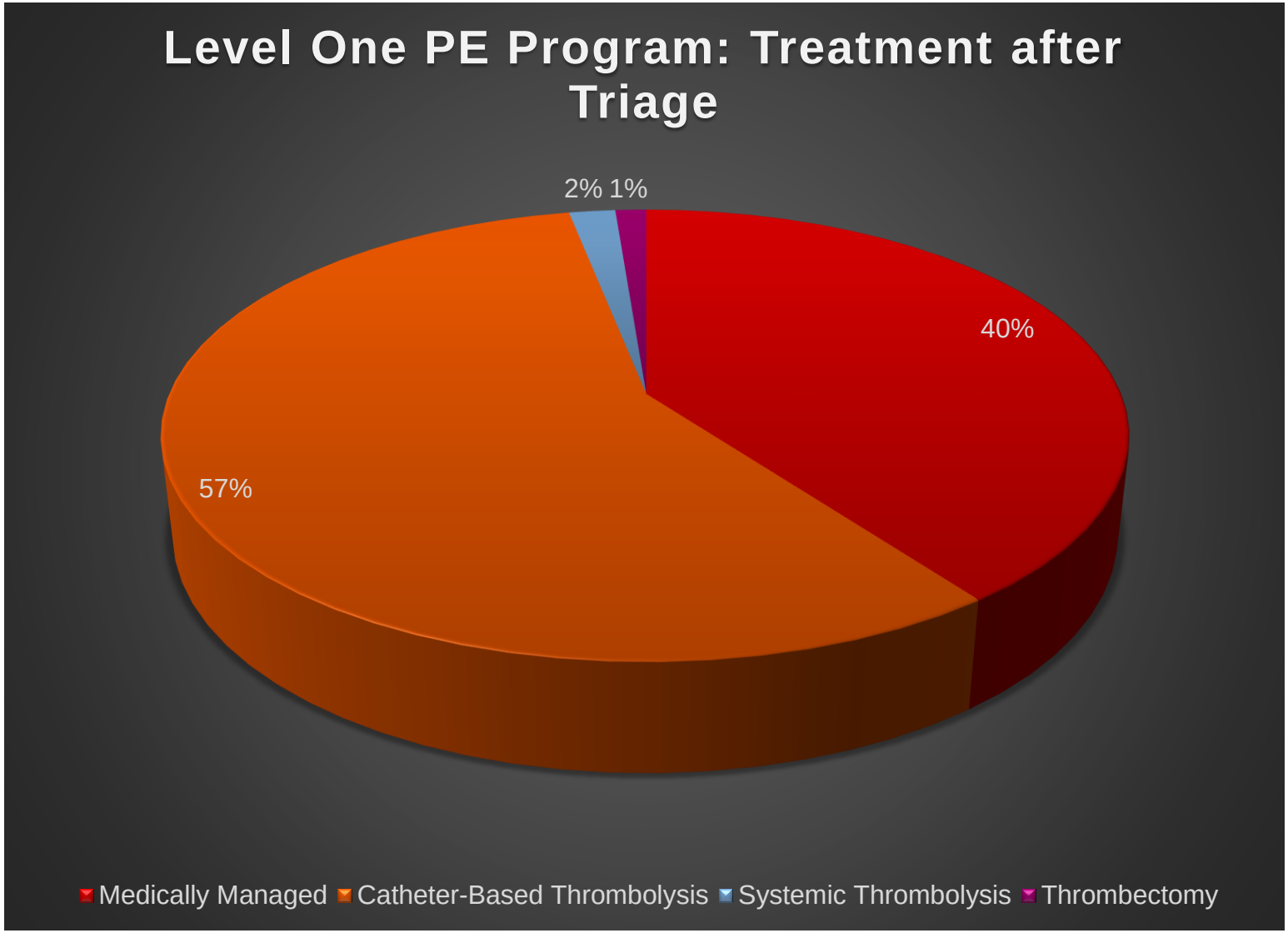
PERT Goals

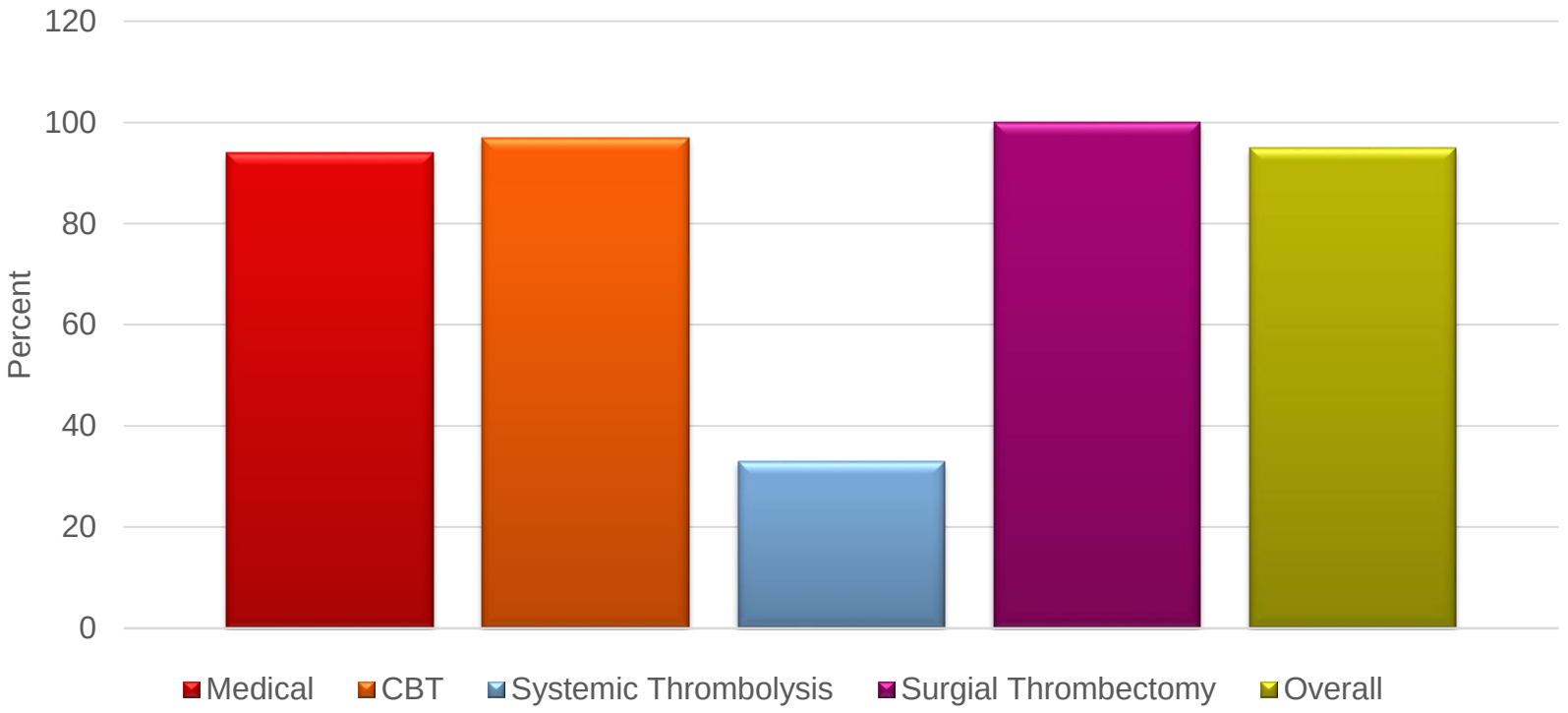
- Facilitate rapid, multidisciplinary consultation, mobilizing resources quickly
- Coordinated outpatient follow-up with Post-PE clinic
- Facilitate research


#PE Cases Triaged by
OSU Level One H&V Emergencies Program
60
50
40
30
20
10
0
22
37
39
51
57
2013
2014
2015
2016
2017

Level One PE Program: Treatment after Triage



Survival to Discharge: Level One PE Cases: OSU



Questions