**Massive and Submassive Pulmonary Embolism Algorithm**

**Hemodynamic or respiratory instability/concern for possible clinical decompensation**

- Continue anticoagulation
- Obtain STAT ECHO, BMP, CBC, troponin, BNP, lactate, INR, PTT, fibrinogen, type and screen, bilateral LE Doppler US
- Avoid arterial or non-compressible venous punctures
- Call 612-863-1000 to activate PE Response Team (Intensivist, Interventional Radiologist, Cardiologist, Pediatrics for ages 15-18)

### Massive PE

- **SBP < 90 or > 40 mm Hg drop from baseline**
- **PE-related need for vasopressors**
- **Shock**

  > YES

- **Consult Cardiology and CV Surgery**
- **Consider ECMO in shock with severe RV or bi-ventricular dysfunction + signs of tissue hypoxia or hypotension requiring high dose catecholamines**

- **Systemic fibrinolysis contraindicated? (see tPA checklist for details)**

- **Stop heparin infusion. Use tPA for PE Order Set #30840**

- **Persistent hypotension/shock**

  > YES

  - **ECMO**
  - **Catheter-Directed Intervention Surgical Embolectomy**

- **NO**

  - **High Risk Features**
    - Moderate to severe RV dysfunction (ECHO, CT)
    - Worsening hemodynamic status
    - Troponin and BNP elevation
    - SPESI ≥1*

  **Rule out alternative cause of the above findings**

  - **High risk of clinical decompensation and low bleeding risk**
    - **YES**
      - **Consider systemic tPA**
    - **NO**
      - **Consider Catheter-Directed Intervention**

  - **High risk of clinical decompensation and increased bleeding risk**
    - **YES**
      - **Systemic anticoagulation alone**
    - **NO**
      - **Assess the need for IVC filter**

**Established indications:**

- Unable to anticoagulate
- Recurrent PE despite adequate anticoagulation

**Consider in:**

- Patients with lower extremity or iliocaval DVT and hemodynamic instability or limited hemodynamic reserve**

**Without High Risk Features**

- **High risk of clinical decompensation and low bleeding risk**

  - **YES**
    - **Consider systemic tPA**
  - **NO**
    - **Consider Catheter-Directed Intervention**

- **High risk of clinical decompensation and increased bleeding risk**

  - **YES**
    - **Systemic anticoagulation alone**
  - **NO**
    - **Assess the need for IVC filter**

**Established indications:**

- Unable to anticoagulate
- Recurrent PE despite adequate anticoagulation

**Consider in:**

- Patients with lower extremity or iliocaval DVT and hemodynamic instability or limited hemodynamic reserve**

**Simplified Pulmonary Embolism Severity Index (SPESI)- predicts overall 30-day mortality**

- Age >80
- History of cancer
- Chronic pulmonary disease
- HR ≥ 110
- SBP <100
- Arterial O₂ saturation < 90%

**Intervention on a case by case basis.**
TPA Checklist  
*Patient-specific risk/benefit assessment is required in each case.*

### Major contraindications
- Active bleeding
- Current or previous intracranial hemorrhage
- Structural intracranial disease
- Ischemic stroke within 3 months
- Head or facial trauma, brain or spine surgery within 12 months (shorter intervals may be applicable)
- Suspected aortic dissection

### Relative Contraindications/Precautions
- Severe, poorly controlled hypertension or current BP ≥ 180/110 mm Hg
- Major non-intracranial bleeding in the last 2 months
- Surgery, trauma, or invasive procedure in the last 2 – 4 weeks
- Traumatic or prolonged (>10 min) cardiopulmonary resuscitation
- Lumbar puncture in the past 3 days
- Vascular puncture at a non-compressible site
- Pericarditis or pericardial effusion
- Platelet count < 100,000 mm³ or anticoagulation resulting in INR > 1.7
- Active peptic ulcer
- Diabetic retinopathy
- Caution in patients currently receiving warfarin, heparin, or antiplatelet drugs
- Caution in pregnancy or h/o parturition in the past 30 days.
- Caution in age > 75 years, Low body weight (< 60 kg)

### Outpatient follow up
PE patients with pulmonary hypertension (RVSP > 40) and/or moderate/severe RV dysfunction should have a repeat ECHO and a cardiology follow up at the MHI Pulmonary Hypertension Clinic 6 - 8 weeks after discharge. Call PH Clinic (612-863-9996/Emily) to make follow-up appointments.

MHI Anticoagulation Clinic follow up in 4 – 6 weeks after discharge. Call 612-863-6800 for appointments.

### IV TPA Administration and Anticoagulation Highlights

#### Reduced Dose tPA (associated with reduced bleeding risk):
- For high risk submassive PE
- Patient weighing >50 kg: 10 mg bolus followed by 40 mg infusion over 2 hours
- Patient weighing ≤50 kg: A total dose of 0.5 mg/kg (10 mg bolus followed by the remaining amount, over 2 hours)

#### Full Dose tPA: 100 mg infusion over 2 hours

**Heparin Infusion:** *Stop heparin prior to IV tPA administration*

1. Check aPTT 1 hour after the IV TPA infusion completion, then q 1 hour as needed if first aPTT is still too high
2. Resume IV Heparin infusion per VTE Protocol without a bolus when aPTT is < 80

### Catheter-Directed Interventions (CDI) for PE

#### Massive PE
- Clot fragmentation or aspiration plus tPA 20-40 mg
- Depending on hemodynamic response, continued local low dose lytic infusion directly into clot (see submassive PE below)

#### Submassive PE
- Local infusion through a catheter
  - Total tPA dose is ~24 mg over 12 or 24 hrs locally
  - Bilateral rate 1 mg/hr x 12 hrs, unilateral rate 0.5 mg/hr x 24 hrs
  - Sub-therapeutic heparin @ 500 units/hr during lysis
  - tPA adjustment if fibrinogen < 200
  - tPA is either stopped or cryoprecipitate is given if fibrinogen<100
  - Hgb, Plt, INR, fibrinogen in 4 hrs, then q 6 hrs
- Therapeutic heparin is continued until in IR suite and restarted when exiting IR suite after completion of procedure (sub-therapeutic heparin regimen during thrombolytic infusion)

#### When thrombolysis absolutely contraindicated
- CDI is reserved for Massive or high risk AND clinically deteriorating Submassive PE
- Mechanical clot fragmentation or catheter-aspiration (both typically less effective without tPA)