Pulmonary Embolism Response Team (PERT)

Disclaimer: *This algorithm has been developed for MD Anderson using a multidisciplinary approach considering circumstances particular to MD Anderson's specific patient population, services and structure, and clinical information. This is not intended to replace the independent medical or professional judgment of physicians or other health care providers in the context of individual clinical circumstances to determine a patient's care. This algorithm should not be used to treat pregnant women.*

Pulmonary Embolism (PE)
Intermediate Risk → See Page 2

Pulmonary Embolism (PE)
High Risk → See Page 3

Pulmonary Embolism (PE)
Low Risk → **NO Need to Contact PERT Team**

APPENDIX A: Criteria for After Hours STAT 2D-ECHO……………………………Page 4
APPENDIX B: Classification of Pulmonary Embolism (PE)…………………………Page 4
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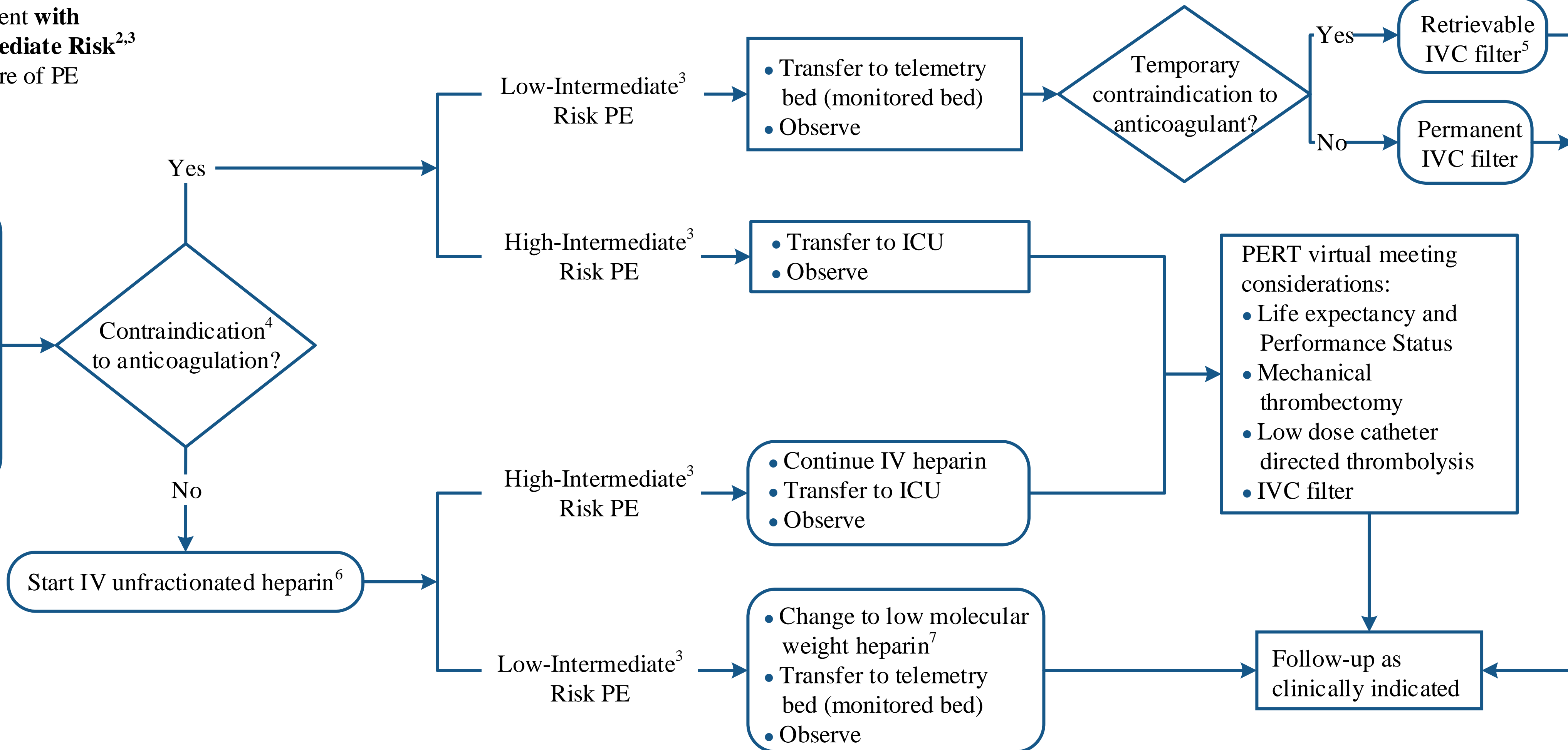
INITIAL EVALUATION – INTERMEDIATE RISK

TREATMENT

PERT First Responder[1] contacted for patient **with Pulmonary Embolism (PE) and Intermediate Risk**[2,3]
- Notify Primary Team if not already aware of PE



[1] PERT First Responder: On-Call fellow/trainee and attending provider
[2] See Appendix A: Criteria for After Hours STAT 2D-ECHO
[3] See Appendix B: Classification of Pulmonary Embolism
[4] See Appendix C: Contraindications to Anticoagulation Therapy
[5] Criteria to consider for placement of a retrievable filter
- If temporary/limited time (less than or equal to 2-3 months) of contraindication to anticoagulants, place a retrievable IVC filter
- Greater than 6 months survival expected
- Performance Status less than or equal to 1

[6] Refer to Adult Heparin Infusion order set
[7] See Appendix D: Low Molecular Weight Heparin (LMWH) Regimens for Treatment of Cancer Associated Thrombosis

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Department of Clinical Effectiveness V2
Approved by The Executive Committee of the Medical Staff on 12/18/2018

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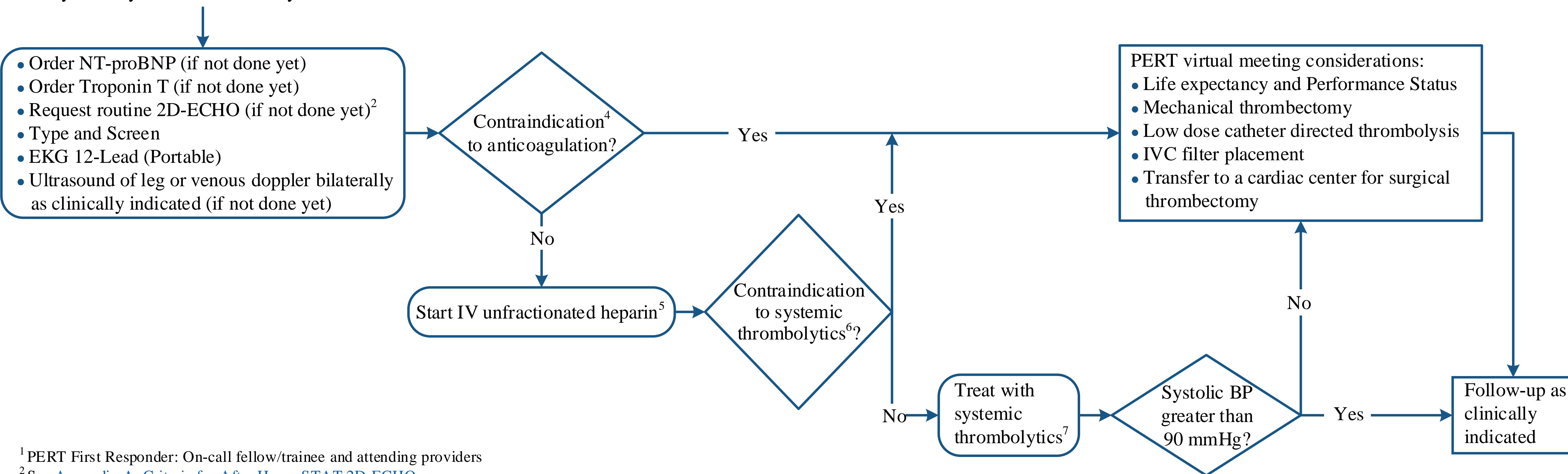
INITIAL EVALUATION – HIGH RISK

TREATMENT



[1] PERT First Responder: On-call fellow/trainee and attending providers
[2] See Appendix A: Criteria for After Hours STAT 2D-ECHO
[3] See Appendix B: Classifications of Pulmonary Embolism
[4] See Appendix C: Contraindications to Anticoagulation Therapy
[5] Refer to Adult Heparin Infusion order set
[6] See Appendix E: Contraindications to Systemic Thrombolysis
[7] Alteplase 100 mg IV infusion over 2 hours. Institute or resume parental anticoagulation near the end of or immediately following the alteplase infusion when the partial thromboplastin time returns to twice normal or less.

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APPENDIX A: Criteria for After Hours STAT 2D-ECHO

Criteria
• Patient has to be seen first by a member of the PERT team in order to confirm that none of the other imaging modalities are possible (CT angiogram or VQ scan) • Patient is hemodynamically unstable (Systolic Blood Pressure (SBP) less than 90 mmHg or receiving vasopressors) • PE has to be highly suspected and no other etiology would explain shock (no septic, hemorrhagic or hypovolemic shock) • PERT team member is to contact and discuss directly the need of the echo with the cardiologist on-call before sonographer is contacted.

APPENDIX B: Classifications of Pulmonary Embolism (PE)

Risk Levels	Classifications
Low Risk	• No hypotension **and** • No RV dysfunction **and** • No myocardial necrosis or strain
Low-Intermediate Risk	• RV dysfunction by CT or ECHO **or** • Myocardial necrosis or strain (elevated Troponin T or NT-proBNP)
High-Intermediate Risk	• RV dysfunction by CT or ECHO **and** • Myocardial necrosis or strain (elevated Troponin T or NT-proBNP) **and/or** • Absence of signs of hypotension or shock
High Risk	• Sustained hypotension (SBP less than 90 mmHg) at least 15 minutes **or** • Persistent bradycardia (HR less than 40 bpm) or signs and symptoms of shock **or** • Need for inotropic support

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APPENDIX C: Contraindications to Anticoagulation Therapy

Absolute Contraindications:	**Relative Contraindications:**
• Cerebral hemorrhage, hemorrhage in the eye or vital organs or a drop in hemoglobin of 2 gm/dL in 24 hours • Neurosurgery, ocular surgery or intracranial bleeding within past 10 days	• Brain metastases conferring risk of bleeding (renal, choriocarcinoma, melanoma, thyroid cancer) • Spinal Procedure and/or epidural placement • Major trauma or head trauma • Major abdominal surgery within 48 hours • Severe hypertension (systolic BP greater than 200 mmHg, diastolic BP greater than 120 mmHg) • Endocarditis/pericarditis • GI, GU bleeding within past 14 days • Preexisting coagulopathy • Platelets less than 50 K/microliter • Hypersensitivity to heparin, low molecular weight heparin (LMWH) or heparin induced thrombocytopenia • Patient on active protocol that prohibits use of anticoagulation • Bleeding diathesis

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APPENDIX D: Low Molecular Weight Heparin (LMWH)[1] Regimens for Treatment of Cancer Associated Thrombosis

DRUG	DOSE / ROUTE / FREQUENCY			MONITORING[2]	DOSE ADJUSTMENTS
Dalteparin (Fragmin®)* ***Preferred choice, FDA approved for cancer patients** • Use dalteparin with caution in patients with platelets less than 50 K/microliter	Round to nearest International Units (IU) dose, given subcutaneously daily			• Baseline CBC with platelets, aPTT, PT and serum creatinine • For surgical patients, platelets every 3 days between days 4 and 14 after beginning LMWH then as clinically indicated	• Consider reducing the daily dose by 50% when platelets are between 20 – 50 K/microliter and to 5,000 International Units when platelets are less than 20 K/microliter • If creatinine clearance less than 30 mL/minute: adjust dose to obtain anti-Xa level of 0.5-1.5 International Units/mL (4-6 hours after fourth dose) • Obtain anti-Xa level in patients weighing greater than 150 kg or less than 50 kg, and adjust dose to obtain anti-Xa level of 1.5 IU/mL (4-6 hours after fourth dose)
	Actual Body Weight (kg)	Month 1 200 IU/kg	Months 2-6 150 IU/kg		
	Less than or equal to 56 57-68 69-82 83-98	10,000 IU 12,500 IU 15,000 IU 18,000 IU	7,500 IU 10,000 IU 12,500 IU 15,000 IU		
	Greater than or equal to 99	Limited data suggests dalteparin 200 IU/kg based on actual body weight (with no dose capping) in one or two divided doses. An alternative option is enoxaparin 1 mg/kg twice daily. Consider monitoring anti-Xa levels and adjust dose as needed.			
Enoxaparin (Lovenox®) • Use enoxaparin with caution in patients with platelets less than 100 K/microliter	1 mg/kg subcutaneously every 12 hours **or** 1.5 mg/kg* subcutaneously daily in selected patients *Limited data suggest once per day dosing is inferior in cancer patients			Same as above	• If creatinine clearance less than 30 mL/minute:1mg/kg daily • Obtain anti-Xa level in patients with weight greater than 150 kg or less than 50 kg a. For 1 mg/kg every 12 hour dosing regimen: adjust dose to obtain anti-Xa level of 0.6-1.0 IU/mL (4-6 hours after fourth dose) b. For 1.5 mg/kg every 24 hour dosing regimen: adjust dose to obtain anti-Xa level of 1.0-1.5 IU/mL (4-6 hours after fourth dose)

[1] Notes:
- LMWH are preferred agents
- If LMWHs are not accessible, consider switching to warfarin after 5 days of LMWH therapy. Heparin and warfarin therapy should overlap 5 days during the acute management of venous thrombosis.
- Patients who tolerate anticoagulation should be continued on it indefinitely or until active cancer resolves
- Patient should be observed closely for bleeding and signs and symptoms of neurological impairment if therapy is administered during or immediately following diagnostic lumbar puncture, epidural anesthesia, or spinal anesthesia

[2] If lab results indicate heparin induced thrombocytopenia, follow management guideline per Heparin Induced Thrombocytopenia (HIT) Treatment algorithm

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APPENDIX E: Contraindications to Systemic Thrombolysis

Absolute Contraindications:	**Relative Contraindications:**
• History of hemorrhagic stroke or stroke of unknown origin • Intracranial tumor • Ischemic stroke in previous 3 months • History of major trauma, surgery or head injury in previous 3 weeks • Platelet count below 100 K/microliter	• Pregnancy or first post-partum week • Non-compressible puncture sites • Traumatic resuscitation • Refractory hypertension (systolic blood pressure greater than 180 mmHg; diastolic blood pressure greater than 100 mmHg) • Advanced liver disease • Infective endocarditis • Recent GI bleed (last 3 months) • Life expectancy less than or equal to 6 months

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