



Hôpital général juif  
Jewish General Hospital

# What's New in DVT & PE

Mark Buch MD CM CCFP(EM)

Attending physician Emergency Department Jewish General Hospital

Family Physician and Medical Director GMF Santé Mont-Royal



# Objectives:

- Review the diagnostic algorithms of the diagnosis and management of DVT and PE.
- Review appropriate use of Ddimer testing.
- Review the PERC rule
- Discuss the outpatient therapeutic options for DVT and PE, with a focus on the outpatient setting.

# Disclosure

- I have no financial or conflict of interest disclosures.

# Case

It's Friday afternoon, a 32 yr female presents with leg swelling since 2 days. No fever, no trauma. On physical exam the RT leg is mildly edematous compared to the left (approx 4 cm difference). You notice pain on palpation of the calf and proximal leg with some unilateral pitting edema. She is otherwise healthy, but takes the oral contraceptive pill. She was admitted to the hospital 2 weeks ago for an acute appendicitis.

he best course of action is:

- A. Send her to the ER
- B. Send a d-dimer stat
- C. Give her a prescription for Xarelto and advise her to go the ER on Monday
- D. Reassure her and give a prescription for Naproxen

## Case 2

A 44 yr male presents in the evening walk in clinic, complaining of chest pain X 4 days. He denies any cough or fever. He has recently taken on a new exercise routine at the gym. He recently drove to Mt Tremblant for a ski trip. He has no leg swelling, no dyspnea. His grandmother was diagnosed with a PE 3 months and according to Google this is a possibility.

Physical exam shows a HR of 80, Sat of 99% on room air.

The best course of action is:

- A. Send him to the ER to rule out a PE
- B. Reassure him that it is unlikely to be PE
- C. Order bilateral leg dopplers
- D. Refer him for a CT scan to rule out PE as an outpatient

# DVT – Why Do I Care

- Progression to PE
- Post thrombotic syndrome
- Phlegmasia cerulea dolens
- Phlegmasia alba dolens



# DVT- Risk factors

- Inherited thrombophilia
- Malignancy
- Trauma
- Pregnancy
- OCP/HRT
- Immobilization
- Heart failure
- Age >65
- Myeloproliferative disorders
- Inflammatory bowel disease

# DVT – signs and symptoms

- Not very reliable
- Leg edema – 97% sensitive, 33% specific
- Pain – 86 % sensitive, 19 % specific
- Warmth – 72% sensitive, 48 % specific

Source: uptodate

- 1/3 symptomatic DVT have concomitant PE
- 70% confirmed PE have a concomitant DVT

Source: Lancet. 2016 Dec 17;388(10063):3060-3073



# DVT- signs and symptoms

- Large calf diameter in a meta analysis doubled likelihood of having DVT
- Calf swelling is measured at 10cm below tibial tuberosity
- Homan's sign – unreliable
- Travel should be considered “immobilization” if greater than 4 hours

CMAJ. 2015 Nov 17;187(17):1288-96. doi: 10.1503/cmaj.141614. Epub 2015 Sep 28.

Uptodate



We are SOOO BAD  
at this

# Well's score to save the day

**Table 1. Clinical Model for Predicting the Pretest Probability of Deep-Vein Thrombosis.\***

Clinical Characteristic	Score
Active cancer (patient receiving treatment for cancer within the previous 6 mo or currently receiving palliative treatment)	1
Paralysis, paresis, or recent plaster immobilization of the lower extremities	1
Recently bedridden for 3 days or more, or major surgery within the previous 12 wk requiring general or regional anesthesia	1
Localized tenderness along the distribution of the deep venous system	1
Entire leg swollen	1
Calf swelling at least 3 cm larger than that on the asymptomatic side (measured 10 cm below tibial tuberosity)	1
Pitting edema confined to the symptomatic leg	1
Collateral superficial veins (nonvaricose)	1
Previously documented deep-vein thrombosis	1
Alternative diagnosis at least as likely as deep-vein thrombosis	-2

\* A score of two or higher indicates that the probability of deep-vein thrombosis is likely; a score of less than two indicates that the probability of deep-vein thrombosis is unlikely. In patients with symptoms in both legs, the more symptomatic leg is used.

N Engl J Med 2003; 349:1227-1235

# Nothing is perfect

- Wells may NOT perform well in
  - Hospitalized patients
  - Elderly
  - Recurrent DVT / PE
  - Cancer patients
  - ?primary care setting

MODERATE  
WELLS SCORE :  
1-2

DDIMER > 500

DDIMER  
< 500

# D-Dimer

- High sensitivity d-dimer assays outperform non HS assays
- HS D-dimer have a higher NPV
- Should not be used as a stand- alone
- **Age adjusted D-dimers**
  - Patients > 50
  - **Age in years X 10**
  - Improves specificity without modifying sensitivity

# Wells + Ddimer

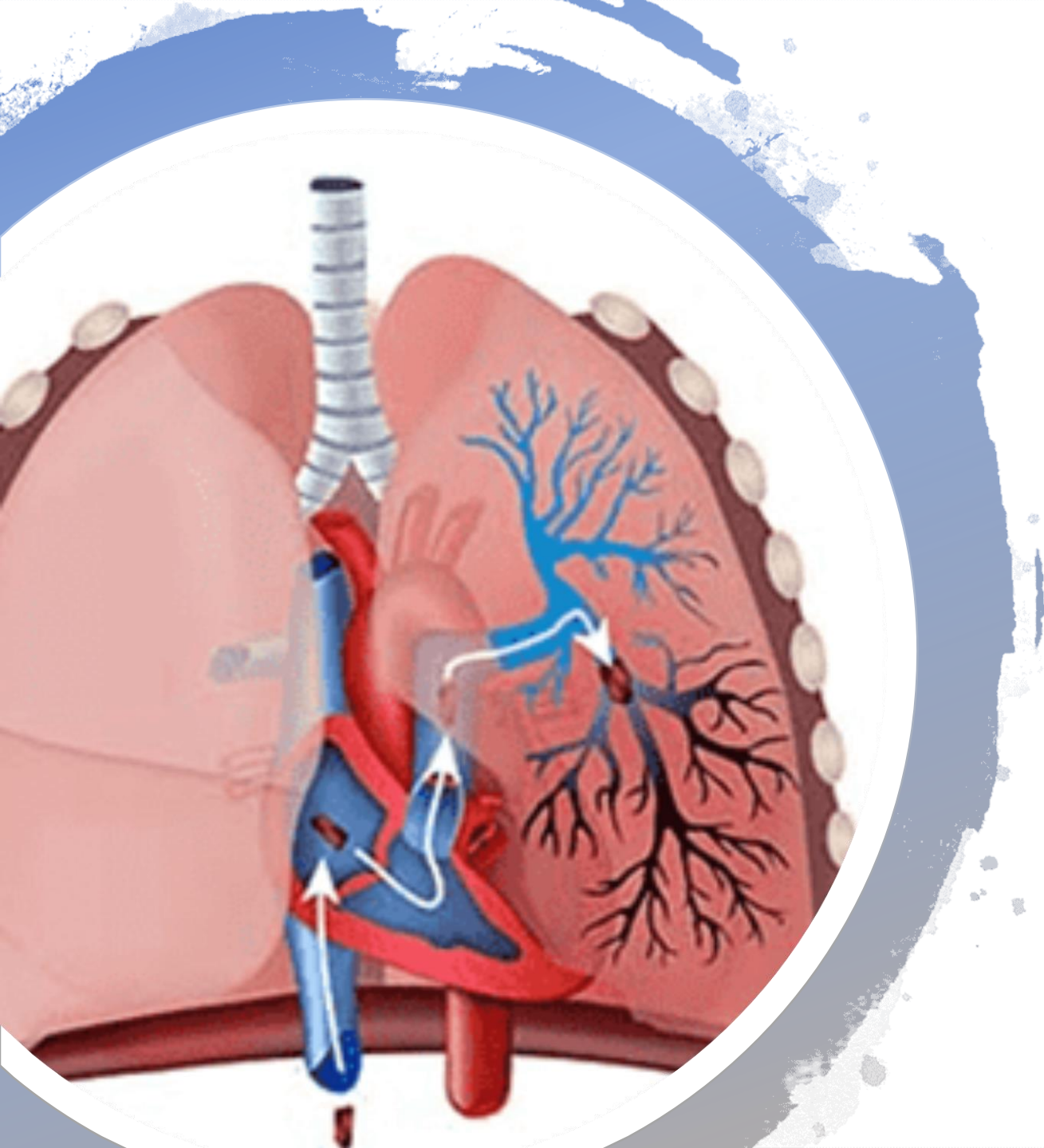
Clinical Pretest Probability	Sensitivity	Specificity	Negative Predictive Value	Negative Likelihood Ratio
Low	88%	72%	99%	0.18
Moderate	90%	58%	96%	0.19
High	92%	45%	84%	0.16

- Reference - [JAMA 2006 Jan 11;295\(2\):199](#), editorial can be found in [JAMA 2006 Jan 11;295\(2\):213](#), commentary can be found in [ACP J Club 2006 Jul-Aug;145\(1\):24](#)

# Confirmatory testing [+D-Dimer or High risk]

- Duplex ultrasound most widely used
- Controversy between whole leg or proximal veins only
- CT-V and MR-V rarely used
- Contrast venography – not used very much at all





# PULMONARY EMBOLISM

# TAKE A DEEP BREATH...

- PE not as a fatal as initially thought
- Newer data 2011 – mortality rate of about 1% , directly related to PE
- 85% of deaths occurred while waiting for diagnostic confirmation, suggesting most patients succumb to their underlying illness

# PE risk factors

- Same as those for DVT
- Virchows triad
  - Venous stasis
  - Endothelial injury
  - Hypercoagulable state
- Up to 50% of PE patient haven no apparent risk factors

# PE – signs and symptoms

- DYS/PNEA!
- Fatigue coinciding with a new dyspnea
- Chest pain
- No chest pain
- Leg swelling
- No leg swelling
- Hemoptysis (although rare)

# Syncope and PE

- Probably overstated
- One international study <1% prevalence of PE in ER presentations with syncope
- A Canadian study showed a 1.4% prevalence of PE in a cohort of admitted patients with syncope
- Flipped T waves in anterior and inferior leads more most SPECIFIC finding in PE
- Most common finding -> NSR




*Prandoni P, et al. Prevalence of Pulmonary Embolism among Patients Hospitalized for Syncope. The New England Journal of Medicine. 2016;375(16):1524-31.*

*Verma AA, Masoom H, Rawal S, Guo Y, Razak F. Pulmonary Embolism and Deep Venous Thrombosis in Patients Hospitalized With Syncope: A Multicenter Cross-sectional Study in Toronto, Ontario, Canada. JAMA Intern Med. 2017;177(7):1046-1048.*

# Approach

## Wells' Criteria for Pulmonary Embolism

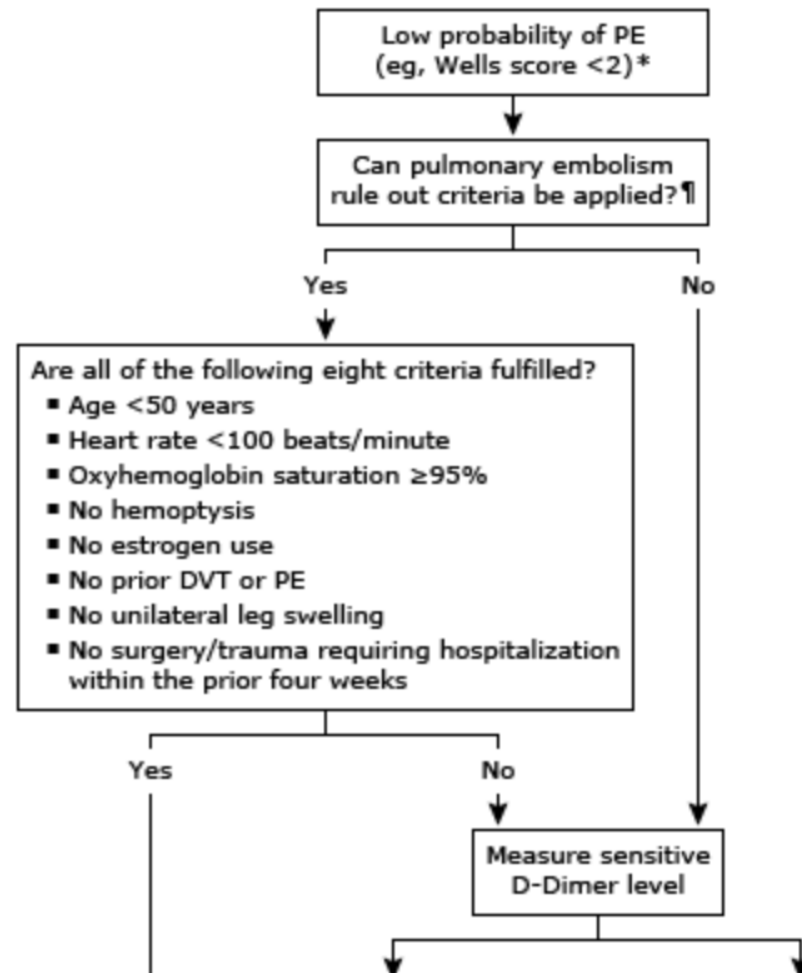
Objectifies risk of pulmonary embolism.

When to Use 	Pearls/Pitfalls 	Why Use 
-------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------

Clinical signs and symptoms of DVT	<input checked="" type="radio"/> No 0	<input type="radio"/> Yes +3
PE is #1 diagnosis OR equally likely	<input checked="" type="radio"/> No 0	<input type="radio"/> Yes +3
Heart rate > 100	<input checked="" type="radio"/> No 0	<input type="radio"/> Yes +1.5
Immobilization at least 3 days OR surgery in the previous 4 weeks	<input checked="" type="radio"/> No 0	<input type="radio"/> Yes +1.5
Previous, objectively diagnosed PE or DVT	<input checked="" type="radio"/> No 0	<input type="radio"/> Yes +1.5
Hemoptysis	<input checked="" type="radio"/> No 0	<input type="radio"/> Yes +1
Malignancy w/ treatment within 6 months or palliative	<input checked="" type="radio"/> No 0	<input type="radio"/> Yes +1

## Evaluation of the nonpregnant adult with low probability of pulmonary embolism

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Source: uptodate

# PERC

- Low risk patients only with a low prevalence
- Study designed with 1.8% threshold

## PERC Rule for Pulmonary Embolism ☆

Rules out PE if no criteria are present and pre-test probability is  $\leq 15\%$ .

When to Use <span>▼</span>	Pearls/Pitfalls <span>▼</span>	Why Use <span>▼</span>
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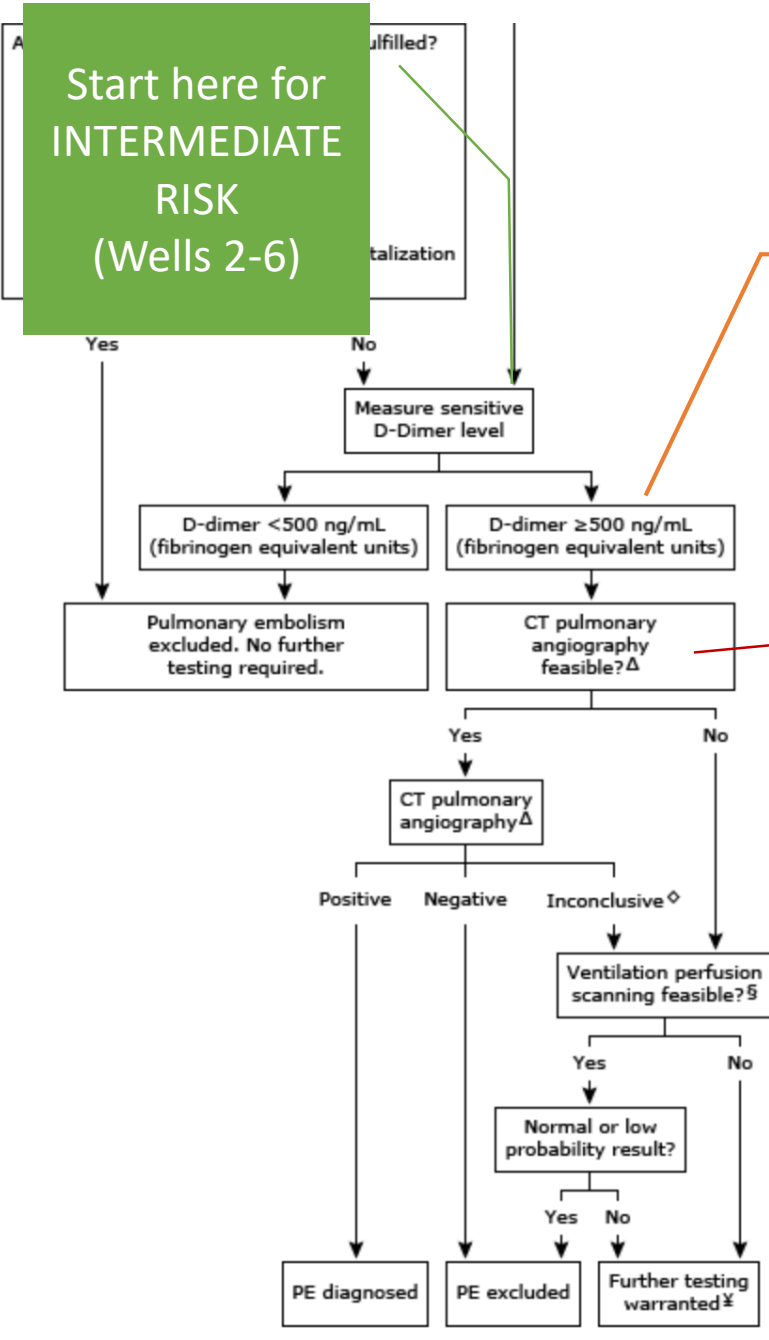
Age $\geq 50$	No 0	Yes +1
HR $\geq 100$	No 0	Yes +1
SaO <sub>2</sub> on room air $< 95\%$	No 0	Yes +1
Unilateral leg swelling	No 0	Yes +1
Hemoptysis	No 0	Yes +1
Recent surgery or trauma Surgery or trauma $\leq 4$ weeks ago requiring treatment with general anesthesia	No 0	Yes +1
Prior PE or DVT	No 0	Yes +1
Hormone use Oral contraceptives, hormone replacement or estrogenic hormones use in males or female patients	No 0	Yes +1

**0** criteria

No need for further workup, as  $< 2\%$  chance of PE.

J Thromb Haemost. 2004 Aug;2(8):1247-55.





Start here for INTERMEDIATE RISK (Wells 2-6)

AGE ADJUSTED D-DIMER

Start here for HIGH RISK (Wells >6)

# CT PE

- The modern “gold standard”
- Over diagnosis
- Almost 100% sensitive for clinically relevant PE
- 5% of high risk patients will develop PE in a few months with a negative CT PE study.

van der Hulle T, van Es N, den Exter PL, et al. Is a normal computed tomography pulmonary angiography safe to rule out acute pulmonary embolism in patients with a likely clinical probability? A patient-level meta-analysis. *Thromb Haemost.* 2017;117(8):1622-1629.

Outcomes following a negative computed tomography pulmonary angiography according to pulmonary embolism prevalence: a meta-analysis of the management outcome studies. *J Thromb Haemost.* 2018 Jun;16(6):1107-1120.

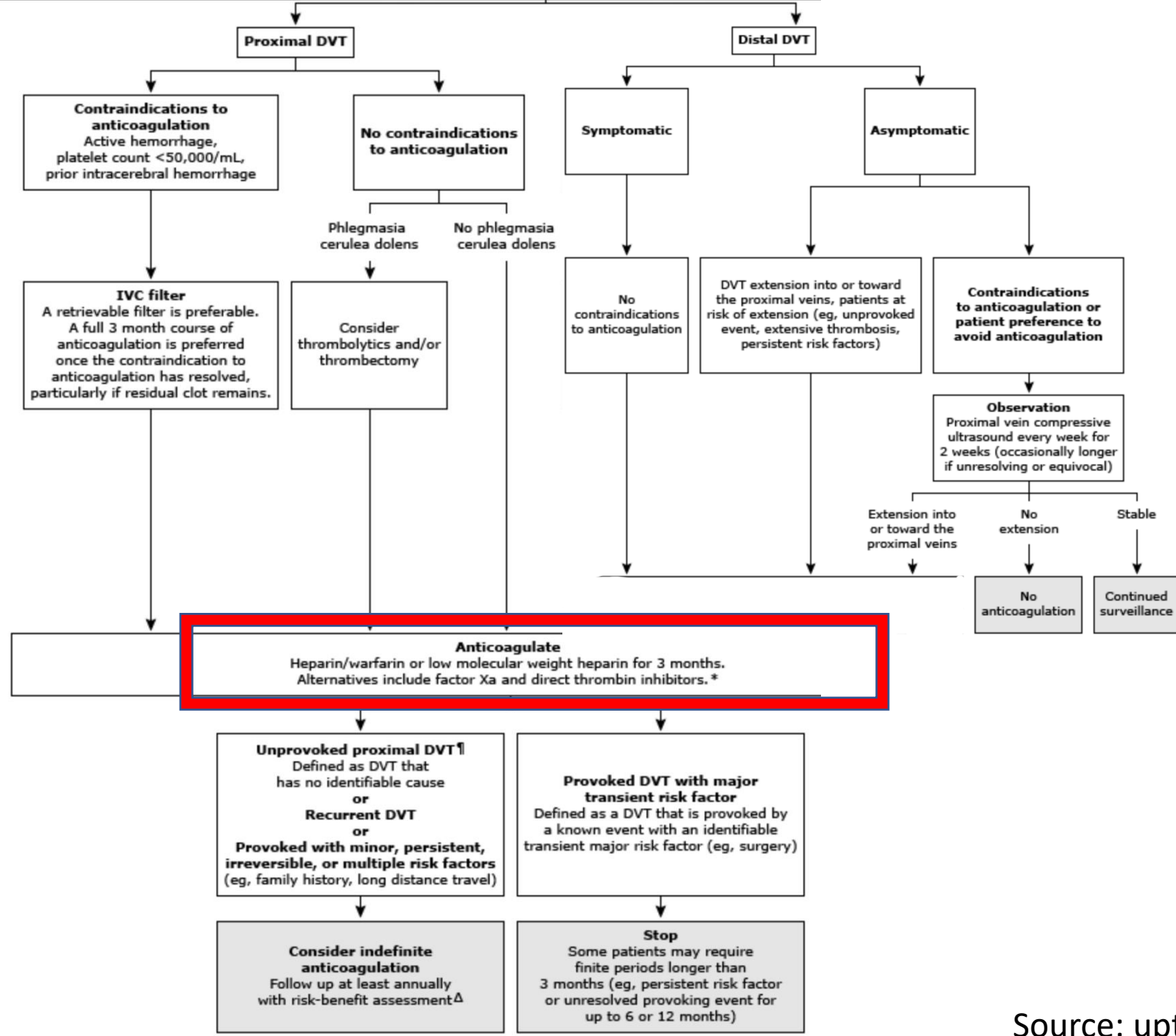
# Subsegmental PE

- Likely not clinically significant
- Consensus recommendations to treat based on individual risk
- Observational study in 2015 of 2213 patients
  - No difference in rate of recurrent PEs between treatment vs non treatment
  - 5% of anti coagulated patients had life threatening bleeds



# TREATMENT

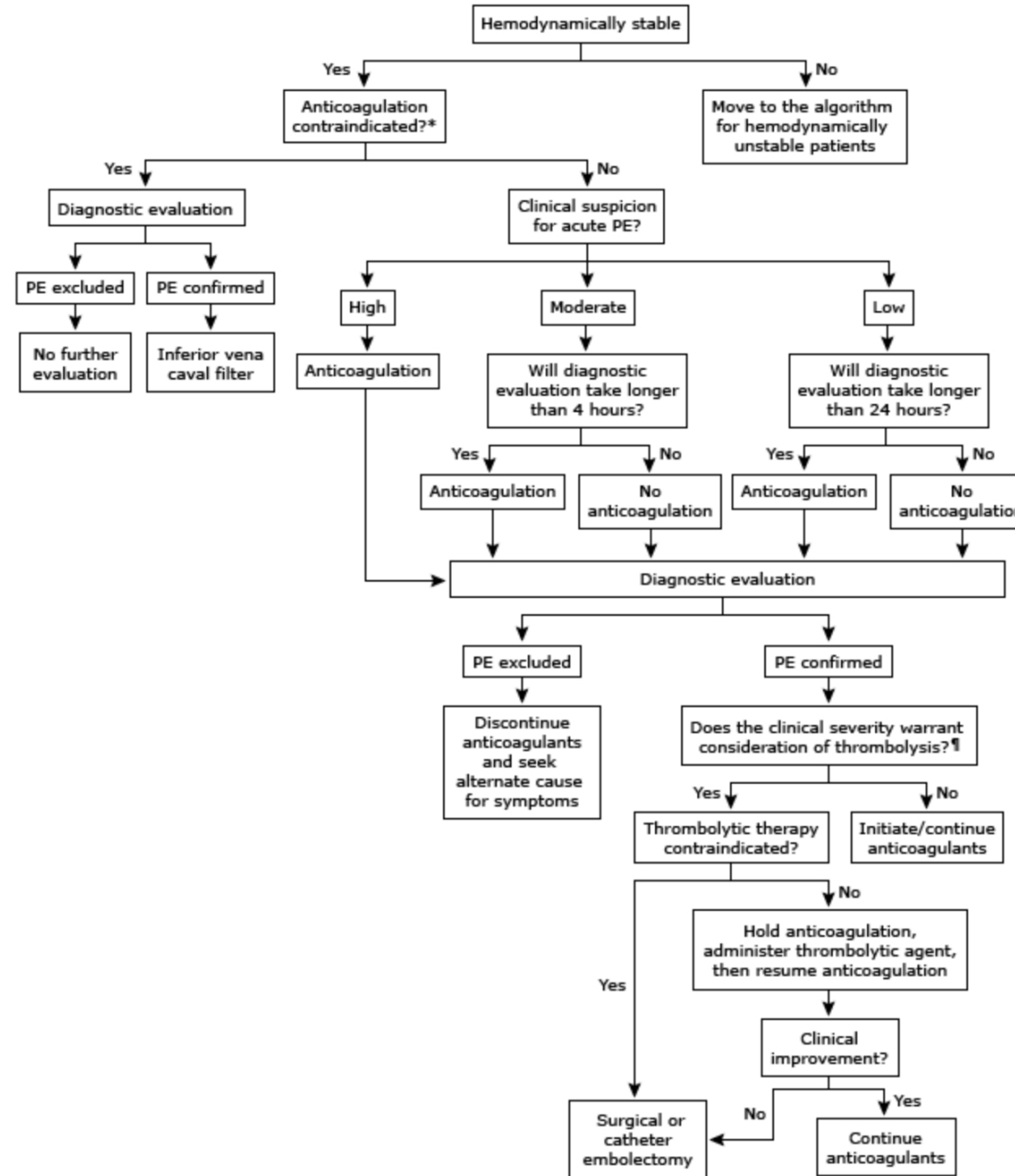
# DVT



Source: uptodate

This algorithm only applies to patients with a **first** episode of DVT.

# PE Algorithm



# Choices of out patient anti coagulation

- LMWH
- DOAC (oral Xa inhibitors) – Rivaroxaban or apixiban
- Warfarin can be used but not acutely
- (IVC filter)

# Generalities about anti coagulation choices

- LMWH is preferred for cancer patients, liver disease, pregnancy
- Avoid DOACs with renal disease
- UFH if admitted, high risk of bleeding
  
- Bottom line: pick the one that you feel most comfortable with initially and above all DO NO HARM






# HAS-BLED score

- Developed to assess bleeding risk in AFIB with anti coagulation
- Estimates 1 yr risk of major bleeding
- Can likely be extrapolated to PE population
- Helpful in decision making for pre testing treatment vs sub segmental PE empiric treatment

<https://www.mdcalc.com/has-bleed-score-major-bleeding-risk#next-steps>

## HAS-BLED Score for Major Bleeding Risk

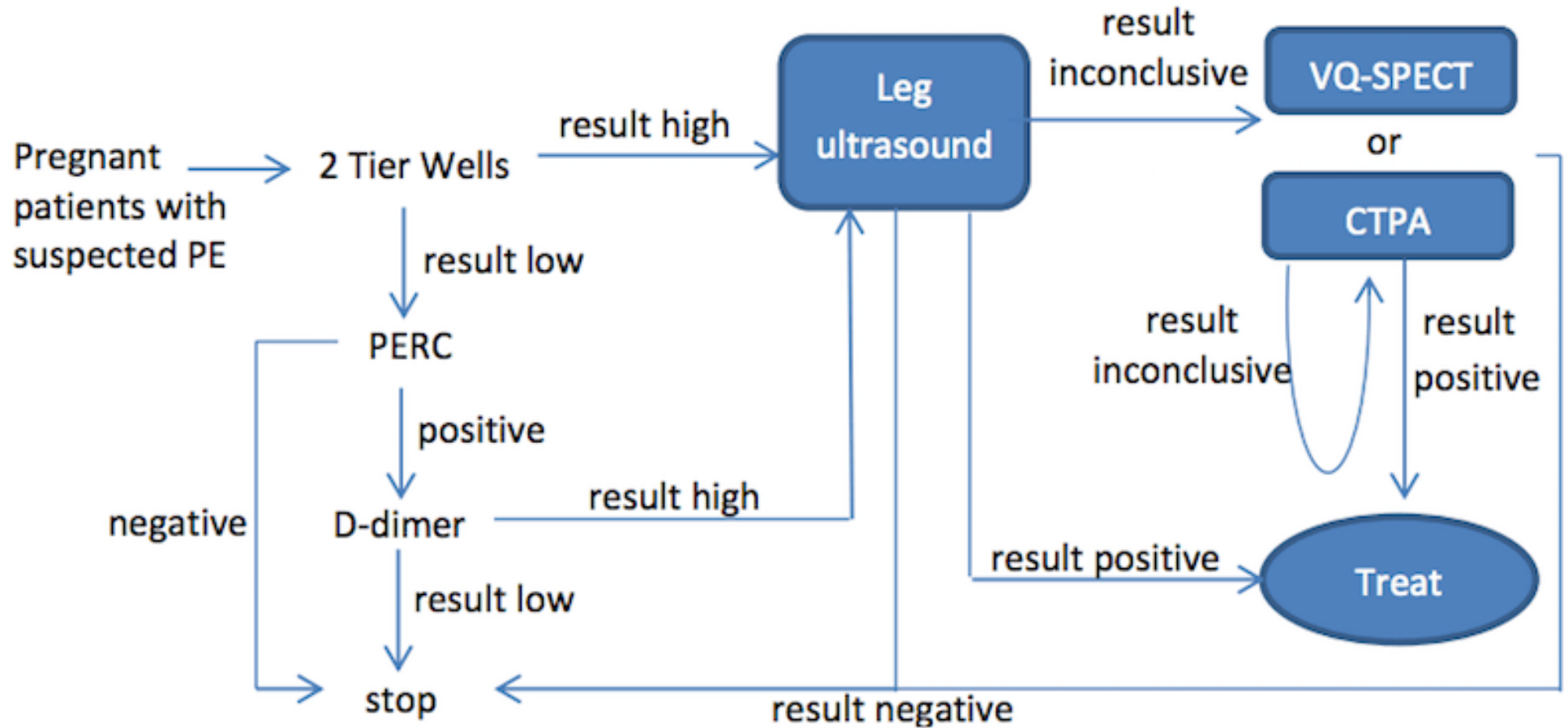
Estimates risk of major bleeding for patients on anticoagulation to assess risk-benefit in atrial fibrillation care.

When to Use 	Pearls/Pitfalls 	Why Use 
Hypertension Uncontrolled, >160 mmHg systolic	<b>No 0</b>	Yes +1
Renal disease Dialysis, transplant, Cr >2.26 mg/dL or >200 µmol/L	<b>No 0</b>	Yes +1
Liver disease Cirrhosis or bilirubin >2x normal with AST/ALT/AP >3x normal	<b>No 0</b>	Yes +1
Stroke history	<b>No 0</b>	Yes +1
Prior major bleeding or predisposition to bleeding	<b>No 0</b>	Yes +1
Labile INR Unstable/high INRs, time in therapeutic range <60%	<b>No 0</b>	Yes +1
Age >65	<b>No 0</b>	Yes +1
Medication usage predisposing to bleeding Aspirin, clopidogrel, NSAIDs	<b>No 0</b>	Yes +1
Alcohol use	<b>No 0</b>	Yes +1

# Pregnancy

- Pregnant patients excluded from decision rules including Wells
- American thoracic society discourages use of D-dimer
- CADTH developed guideline for PE work up in Pregnancy

# CADTH suggested guideline for PE in Pregnancy



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