



**ICT 2023**

28th International  
Congress on Thrombosis

# Cancer-associated pulmonary embolism (PE)



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## Declaration of Conflict Of Interest

**I have no potential conflict of interest to report**

# Cancer-associated pulmonary embolism (PE)

## Outline

- Introduction
- Risk-assessment models for cancer-associated PE
- Potential outpatient management in patients with cancer
- Conclusions



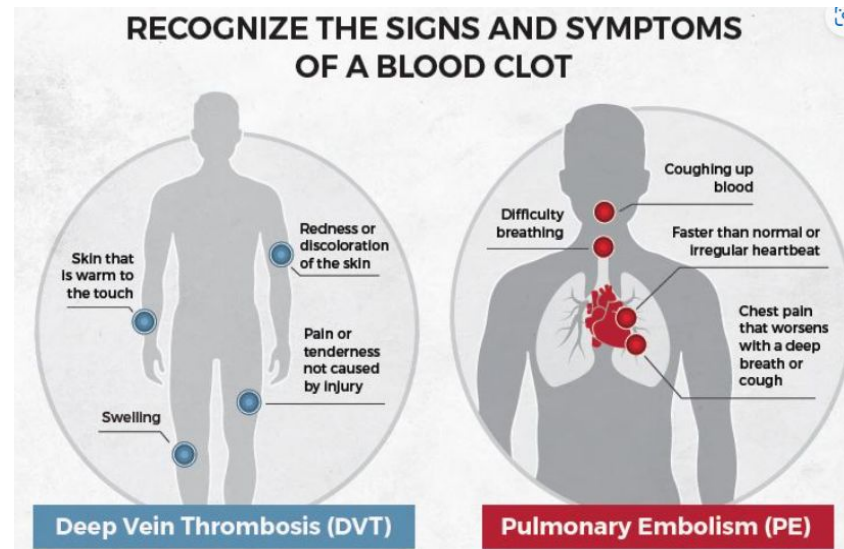
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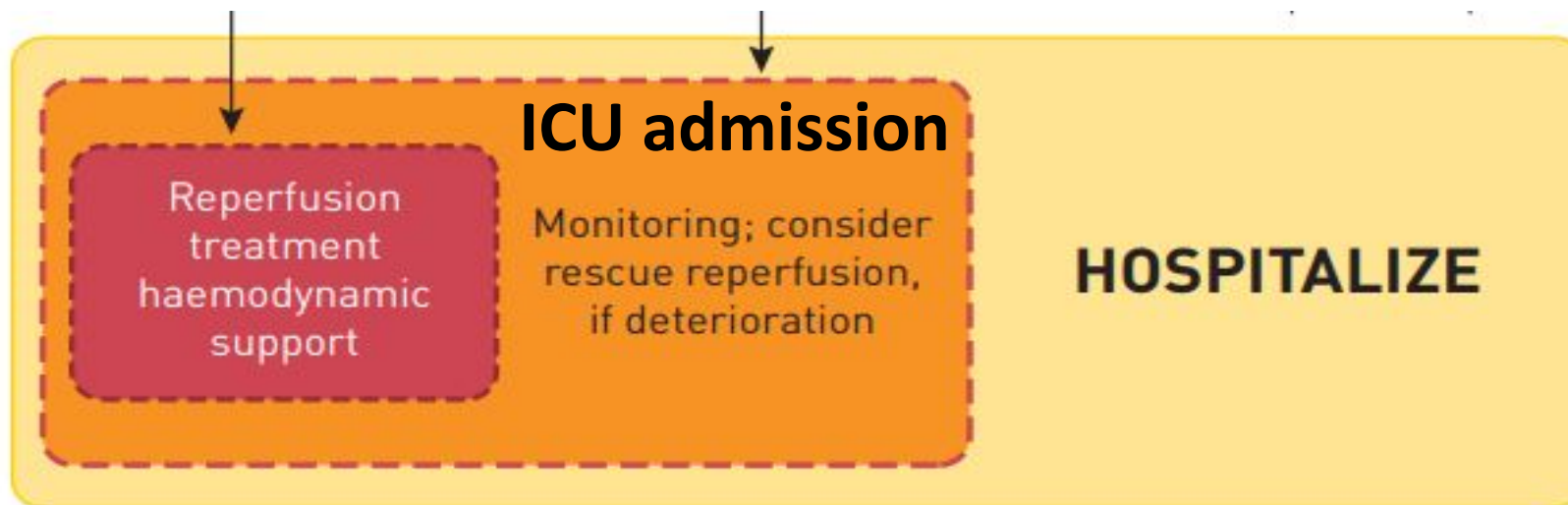
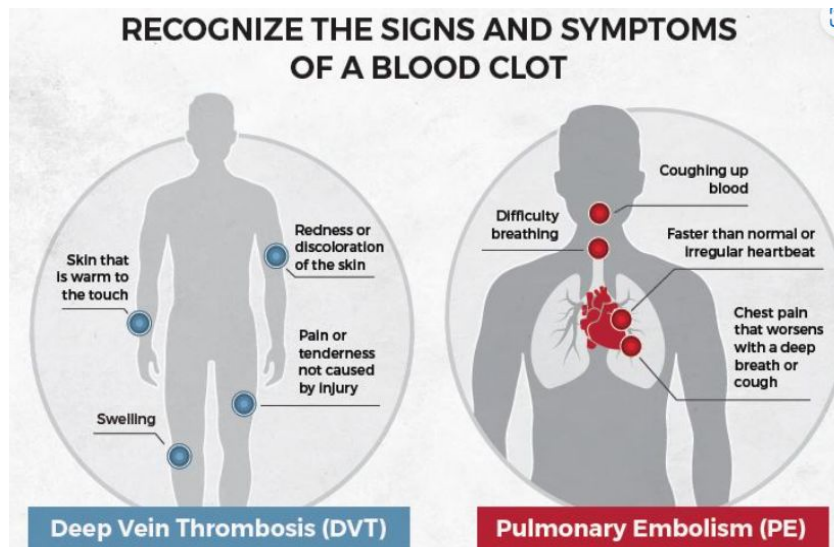


# Wide range of clinical presentation of acute PE



**Acute life-threatening condition** -> **Acute chest symptoms**-> **Mild symptoms** **Syncope**,  
**sudden death**, **Chest pain, hemoptysis**, **Asymptomatic**  
**Tachycardia, hypoxemia**, **unspecific clinical picture** **Incidental PE**  
**Haemodynamic instability**  
**Right ventricular overload**

# Wide range of clinical presentation of acute PE



# Risk-assessment models (RAMs) for the general population with acute PE

Clinical variables	Geneva Prognostic Score (GPS)	PESI	Simplified PESI (sPESI)
-Age			
-Co-morbidities (VTE history, heart and lung conditions, <b>cancer</b> )	<b>Cancer</b> +2 <b>SBP &lt;100mmHg</b> +2	<b>Cancer</b> +30 Age (in years)	<b>Cancer</b> +1 Age >80 years +1
	P02 <60 mmHg +1	Male sex +10	Heart or Lung condition +1
	History of VTE +1	Chronic heart failure +10	
<b>-Acute severity:</b>	Concomitant DVT +1	Chronic lung disease +10	HR $\geq$ 110 +1
<b>-Blood pressure (BP)</b>		Heart rate $\geq$ 110 +20	SBP <100 +1
-Heart rate (HR)		<b>SBP &lt; 100</b> +30	02 saturation <90 +1
-02 saturation		Respiratory rate > 30 +20	
		Temperature < 36°C +20	
		Altered mental status +60	
		02 saturation <90% +20	
<b>30-day all-cause mortality rate</b>			
	<b>Low risk <math>\leq</math> 2</b> <b>2.2%</b>	<b>Low-risk (<math>\leq</math> 85)</b> <b>0-3.5%</b>	<b>Low risk (0)</b> <b>1%</b>
	<b>Non-low-risk &gt;2</b> <b>26.1%</b>	<b>Non-low-risk (&gt;86)</b> <b>3.2-24.5%</b>	<b>Non-low-risk <math>\geq</math> 1</b> <b>10.9%</b>

# Risk-assessment models (RAMs) for the general population with acute PE

**Patients with cancer:**

**\*Not-low risk PE**

**\*Scarce information on the specific clinical characteristics and outcomes**

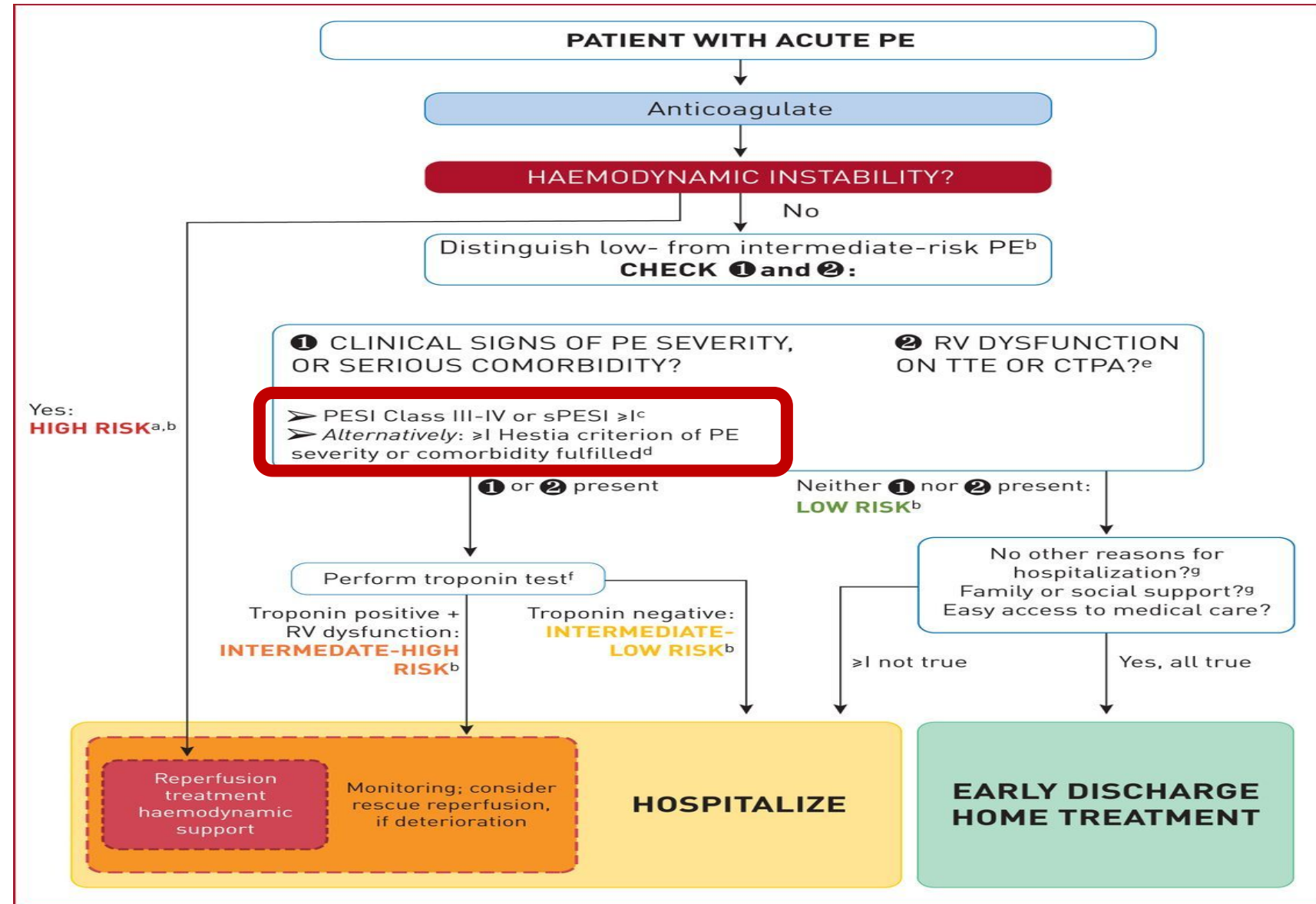
Geneva Prognostic Score (GPS)	PESI	Simplified PESI (sPESI)
<b>Cancer</b> +2 <b>SBP &lt;100mmHg</b> +2 P02 <60 mmHg +1 History of VTE +1 Concomitant DVT +1	<b>Cancer</b> +30 Age (in years) Male sex +10 Chronic heart failure +10 Chronic lung disease +10 Heart rate $\geq$ 110 +20 <b>SBP &lt; 100</b> +30 Respiratory rate > 30 +20 Temperature < 36°C +20 Altered mental status +60 O2 saturation <90% +20	<b>Cancer</b> +1 Age >80 years +1 Heart or Lung condition +1 HR $\geq$ 110 +1 SBP <100 +1 O2 saturation <90 +1
<b>30-day all-cause mortality rate</b>		
<b>Low risk <math>\leq</math> 2</b> 2.2% <b>Non-low-risk &gt;2</b> 26.1%	<b>Low-risk (<math>\leq</math> 85)</b> 0-3.5% <b>Non-low-risk (&gt;86)</b> 3.2-24.5%	<b>Low risk (0)</b> 1% <b>Non-low-risk <math>\geq</math> 1</b> 10.9%
<b>Proportion of cancer patients in the derivation cohorts</b>		
54/296 ( <b>18.2%</b> )	2060/10354 ( <b>19.9%</b> )	239/995 ( <b>24%</b> )

# 2019 ERS/ESC Guidelines for the management of acute PE

Patients with cancer:

\*Not-low risk PE

\*Scarce information on the specific clinical characteristics



# RAMs for the general population with acute normotensive PE

## Clinical variables (NO cancer)

## Radiological signs of right ventricular (RV) dysfunction

## Biomarkers of myocardial damage:

\*Troponins

\*Heart-type fatty acid binding protein (H-FABP)

BOVA score		FAST score	
Systolic BP 90-100 mmHg	+2	Pulse rate $\geq$ 110	+2
Pulse rate $\geq$ 110	+1	Syncope	+1.5
Elevated cardiac troponins	+2	H-FABP $\geq$ 6 ng/mL or elevated cardiac troponins	+1.5
RV dysfunction (TTE or CTPA)	+2		
Risk stratification – 30 PE-related mortality		Risk stratification 30-day all cause mortality	
Low-risk <3	3.1%	Low-risk <3	2.7%
Intermediate-low risk 3-4	6.8%	Intermediate-high-risk $\geq$ 3	5.6%
Intermediate-high risk >4	10%		

# RAMs for the general population with acute normotensive PE

## Patients with cancer:

\*Scarce information on the specific clinical characteristics and outcomes

BOVA score		FAST score	
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Intermediate-high risk >4	10%		
Proportion of patients with cancer in derivation cohorts			
551 / 2874 ( <b>19%</b> )		168 / 859 ( <b>19.6%</b> )	

# Cancer-associated pulmonary embolism (PE)

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- Introduction
- **Risk-assessment models for cancer-associated PE**
- Potential outpatient management in patients with cancer
- Conclusions



# RAMs for patients with acute cancer-associated PE

## POMPE-C tool

### Patient weight

Respiratory rate

Oxygen saturation

Heart rate >100

Altered mental status

Respiratory distress

**Do not resuscitate order**

Unilateral limb swelling

30-day death probability according to math calculation

### POMPE-C Tool for Pulmonary Embolism Mortality ☆

Predicts mortality for cancer patients with PE.

When to Use ▾

Pearls/Pitfalls ▾

Why Use ▾

#### About the Creator



Dr. Jeffrey Kline

[Are you Dr. Jeffrey Kline?](#)

# RAMs for patients with acute cancer-associated PE

## POMPE-C tool

### Patient weight

Respiratory rate

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## The RIETE score

Metastatic disease +4

Immobilization +2

**Age >80 years +1**

Heart rate  $\geq$  110 bpm +1

Systolic BP <100 +1

**Body weight <60 Kg +1**

### 30-day overall mortality

Low risk <2 0-4%

Intermediate risk 2-4

High risk 5-7

Very high risk >7 20-30%

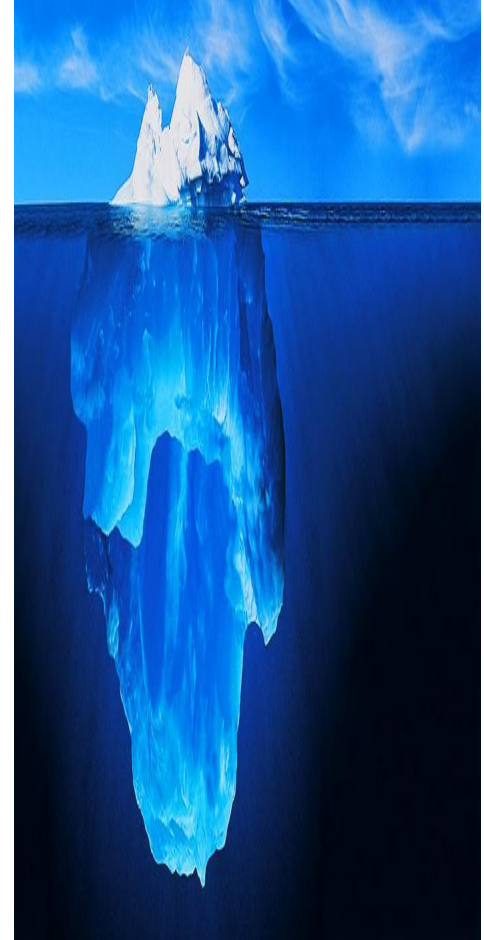
# The emerging challenge of **incidental or unsuspected PE** in patients with cancer

## Unsuspected pulmonary embolism on CT scanning: yet another headache for clinicians?

Sujal R Desai

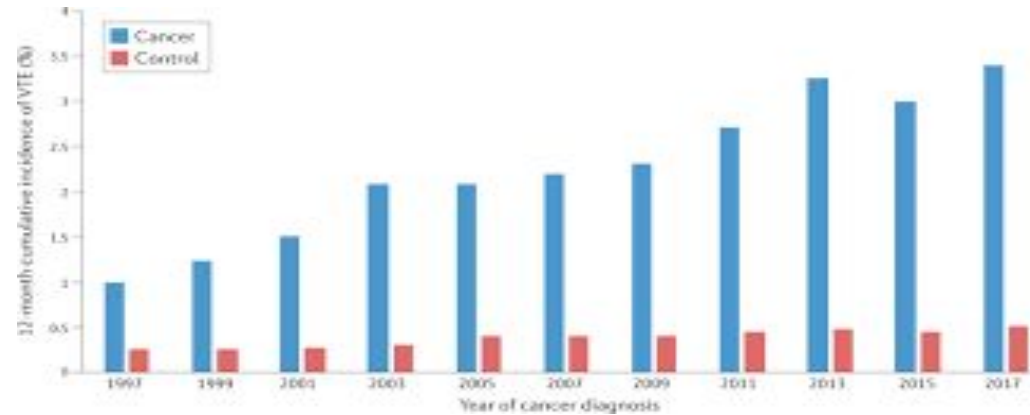
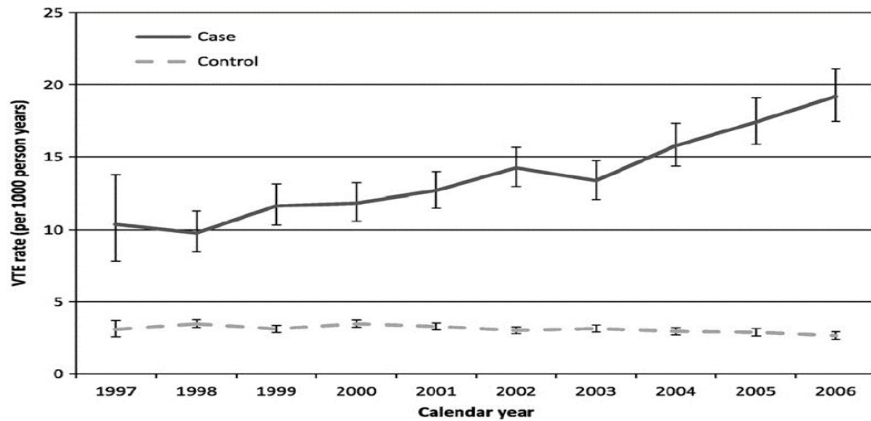
Arguments for and against treatment of **small** unsuspected pulmonary emboli

?



# The emerging challenge of incidental or unsuspected PE

- Reported in **2-5%** of scheduled CT scans
- **50%** of the PEs in patients with cancer
- **60%** of VTE events are incidental in cancer outpatients starting chemotherapy
- **Growing incidence of cancer-associated VTE**



# The emerging challenge of incidental or unsuspected (UPE)

Systematic review and meta-analysis

**28,626 patients.**

UPE was identified in 963 patients (**3.36%**, 95% CI = 3.15; 3.57).

Highest frequency:

**Prostate cancer (8.59%**, 95%CI = 3.74; 13.44)

**Hepatobiliary carcinoma (6.07%**, 95%CI = 3.09; 9.05)

**Pancreatic cancer (5.65%**, 95%CI = 3.54; 7.76).

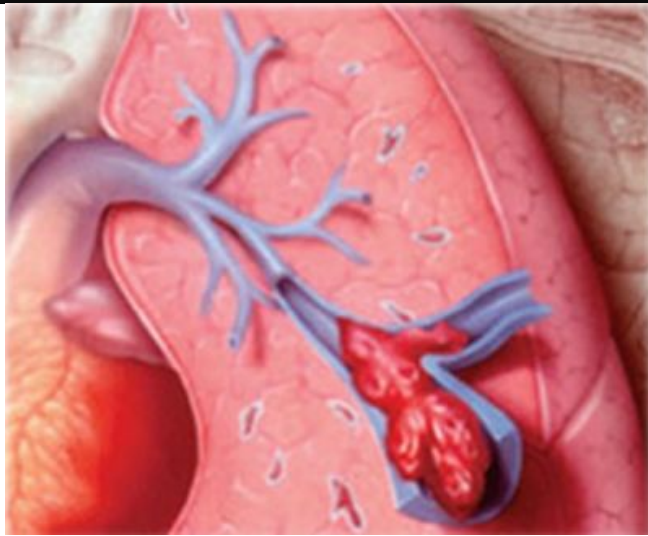
Lowest frequencies:

**Male reproductive organs (0.79%**, 95%CI = 0.21; 1.37)

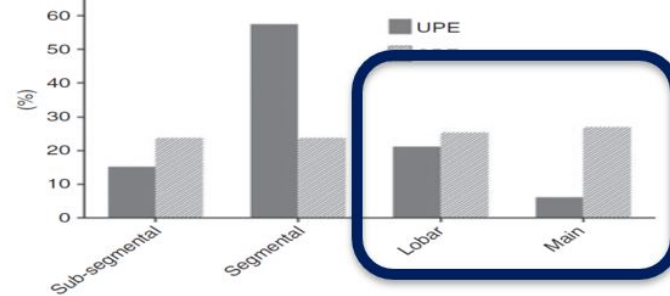
**Hematological diseases (1.11%** 95%CI = 0.74; 1.48)

# Radiological PE burden of incidental or unsuspected PE

**Not so small:  
50% involving main or lobar arteries**



**D'Izarn Thromb Haemost 2012**



**Brown J Thorac Oncol 2010**

Most proximal divisional location of PE per patient

Main	4 (22)
Lobar	5 (28)
Segmental	6 (33)
Subsegmental	3 (17)

**Font Ann Oncol 2011**

	SVT (%) N = 63	IVT (%) N = 56	P
Central arteries	33 (52)	36 (64)	NS
Bilateral	41 (65)	23 (41)	0.009
Multiple PE	55 (87)	42 (75)	NS
Single peripheral PE	6 (10)	7 (13)	NS

**Den Exter J Clin Oncol 2011**

Mean age, years	64	60	.079		
SD	15	14			
Male sex	30	58.8	71	49.3	.242
VTE site					.987
Isolated PE	46	90.2	130	90.3	
Largest artery involved					.421
Main or lobar	11	21.6	34	23.6	
Segmental	20	52.0	84	59.2	
Subsegmental	4	7.8	18	12.5	
Unknown	6	11.8	8	5.6	

**Peris Eur Resp J 2016**

Chest CT findings			
Largest arteries involved:			
Segmental or subsegmental	123 (27)	84 (32)	0.80 (0.58-1.12)
Pulmonary or lobar	266 (59)	129 (49)	1.50 (1.11-2.04)

# Clinical impact of incidental or unsuspected PE

## Symptomatic vs. Asymptomatic



**Table 3.** Signs and Symptoms Among Patients With and Without Unsuspected PE

Symptom	Case Patients		Control Patients		Odds Ratio*	P*
	No.	%	No.	%		
Chest pain	3	7	6	7	0.94	.93
Fatigue	25	<b>54%</b>	18	20%	<b>2.02</b>	<b>.002</b>
Limb pain or swelling	7	15	14	15	1.07	.97
Shortness of breath	10	<b>22%</b>	7	8%	<b>2.82</b>	<b>.02</b>
Tachycardia or palpitations	7	15	12	13	1.21	.72

# Clinical impact of incidental or unsuspected PE

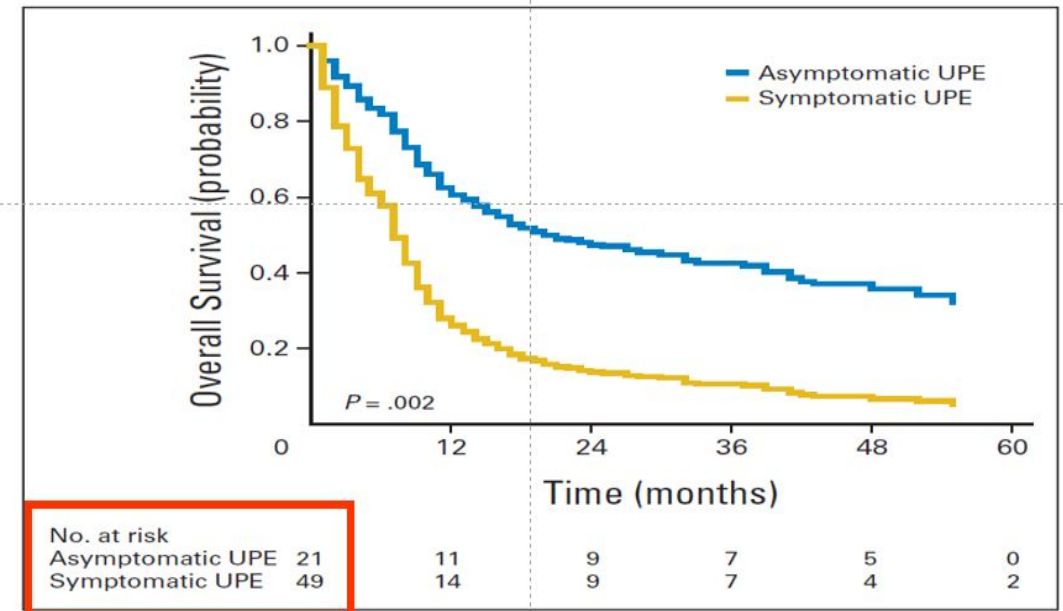
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### Symptoms Adversely Impact Survival Among Patients With Cancer and Unsuspected Pulmonary Embolism



# Clinical impact of incidental or unsuspected UPE

## Outcomes

Risk of recurrent venous thromboembolism and major hemorrhage in cancer-associated incidental PE: a **pooled analysis** of 926 patients

926 cancer patients with **UPE** from 11 cohorts.

### 6-month follow-up

<b>Recurrent VTE</b>	<b>5.8% (95% CI 3.7-8.3%)</b>
<b>Major bleeding</b>	<b>4.7% (95% CI 3.0-6.8%)</b>
<b>Mortality</b>	<b>37% (95% CI 28-47%)</b>

# Clinical impact of incidental or unsuspected UPE

## Outcomes

Risk of recurrent venous thromboembolism and major hemorrhage in cancer-associated incidental PE: a pooled analysis

926 cancer patients with UPE from 11 cohorts.

### 6-month follow-up

Recurrent VTE                      5.8% (95% CI 3.7-8.3%)

VTE recurrence risk was comparable in:  
Subsegmental IPE vs. more proximally localized IPE

# Clinical impact of incidental or unsuspected UPE

## Outcomes

International Prospective Observational Registry  
N=695 patients with UPE

### 12-month follow-up:

- **Recurrent VTE: 6.0%**; 95% CI, 4.4% to 8.1%)
- **Major bleeding: 5.7%**; 95% CI, 4.1% to 7.7%)
- **Mortality: 43%**; 95% CI, 39% to 46%).

# Clinical impact of incidental or unsuspected UPE

## Outcomes

International Prospective Observational Registry  
N=695 patients with UPE

### 12-month follow-up:

- **Recurrent VTE: 6.0%**; 95% CI, 4.4% to 8.1%)
- **Mortality: 43%**; 95% CI, 39% to 46%).

**N=36 (5%) Single subsegmental PE**

**SIMILAR OUTCOMES** (recurrent PE, mortality)

for **single subsegmental PE** vs. multiple subsegmental or more proximal PE

# Clinical impact of incidental or unsuspected UPE

## Outcomes

International Prospective Observational Registry N=695 patients with unsuspected PE

Kraaiipoel N J Clin Oncol 2019

The prognostic value of respiratory symptoms and performance status in ambulatory cancer patients and UPE.

Multivariate logistic regression analysis, the most consistent predictors of mortality:

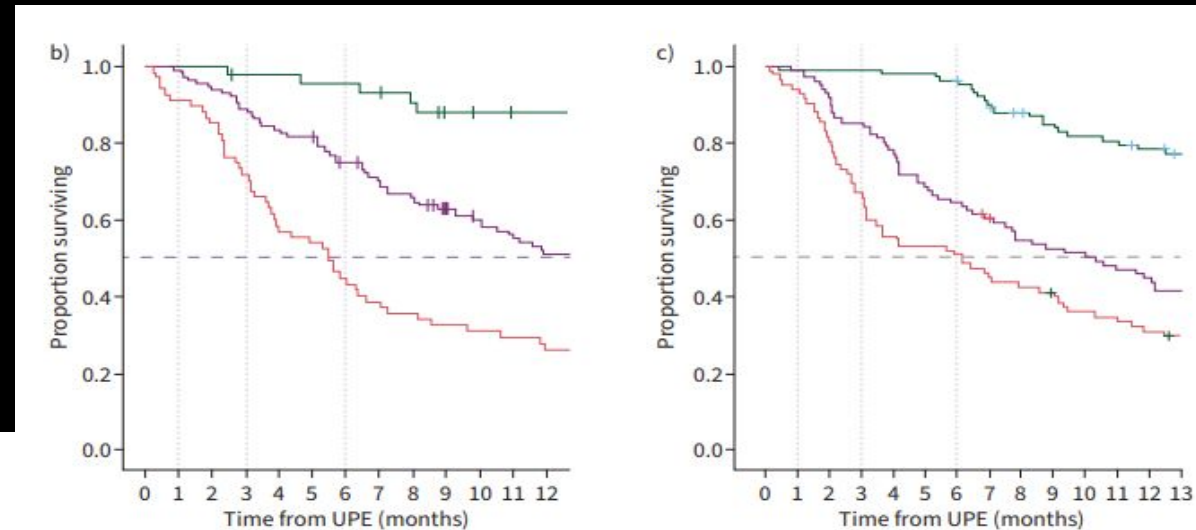
**Patient-reported respiratory symptoms (within 14 days before)**

**Performance status**

**The Hull score CPR**

5-point scoring system

Low – Intermediate – High risk



# Clinical impact of incidental or unsuspected PE

## Outcomes

### LMWH vs DOACs trials

#### Hokusai cancer 2018

ORIGINAL ARTICLE

##### Edoxaban for the Treatment of Cancer-Associated Venous Thromboembolism

Gary E. Raskob, Ph.D., Nick van Es, M.D., Peter Verhamme, M.D., Marc Carrier, M.D., Marcello Di Nisio, M.D., David Garcia, M.D., Michael A. Grosso, M.D., Ajay K. Kakkar, M.B., B.S., Michael J. Kovacs, M.D., Michele F. Mercuri, M.D., Guy Meyer, M.D., Annelise Segers, M.D., Minggao Shi, Ph.D., Tzu-Fei Wang, M.D., Erik Yeo, M.D., George Zhang, Ph.D., Jeffrey I. Zwickler, M.D., Jeffrey I. Weitz, M.D., and Harry R. Buller, M.D., for the Hokusai VTE Cancer Investigators\*

#### SELECT-D 2018

JOURNAL OF CLINICAL ONCOLOGY RAPID COMMUNICATION

##### Comparison of an Oral Factor Xa Inhibitor With Low Molecular Weight Heparin in Patients With Cancer With Venous Thromboembolism: Results of a Randomized Trial (SELECT-D)

Annie M. Young, Andrea Marchetti, Jenny Thirlwall, Oliver Chapman, Anand Lokani, Catherine Hill, Donalada Palla, Jennifer Chan, Gary H. Lyman, Charles Barkham, Peter MacCallum, Amy Walker, F.D. Richard Hobbs, Stavros Petou, Emily Dale, Christopher J. Poole, Anthony Maraveyas, and Mark Laine\*

#### Caravaggio 2020

ORIGINAL ARTICLE

##### Apixaban for the Treatment of Venous Thromboembolism Associated with Cancer

Giancarlo Agnelli, M.D., Cecilia Becattini, M.D., Guy Meyer, M.D., Andres Muñoz, M.D., Menno V. Huisman, M.D., Jean M. Connors, M.D., Alexander Cohen, M.D., Rupert Bauersachs, M.D., Benjamin Brenner, M.D., Adam Torbicki, M.D., Maria R. Suenro, M.D., Catherine Lambert, M.D., Gualberto Gussoni, M.D., Mauro Campanini, M.D., Andrea Fontanella, M.D., Giorgio Vescovo, M.D., and Melina Verso, M.D., for the Caravaggio Investigators\*

### THROMBOSIS AND HEMOSTASIS

## Direct oral anticoagulants for cancer-associated venous thromboembolism: a systematic review and meta-analysis

Fri  
Pie

Table 1. Baseline characteristics and 6-month study outcomes of included randomized trials

Study name	Year	Treatment allocation*	Baseline characteristics							Study outcomes			
			Male	Age (mean/median with SD/IQR), y	Index event PE ± DVT	Incidental VTE	Prior VTE	Metastatic disease†	Gastro-intestinal cancer	Recurrent VTE‡	Major bleeding	Clinically relevant nonmajor bleeding	All-cause mortality
Hokusai VTE Cancer	2018	Edoxaban, n = 522‡	277 (53.1)	64 ± 11	328 (62.8)	167 (32.0)	49 (9.4)	274 (52.5)	165 (31.6)	34 (6.5)	29 (5.6)	64 (12.3)	140 (26.8)
		Dalteparin, n = 524	263 (50.2)	63 ± 12	329 (62.8)	173 (33.0)	63 (12.0)	280 (53.4)	140 (26.7)	46 (8.8)	17 (3.2)	43 (8.2)	127 (24.2)
Select-D	2018	Rivaroxaban, n = 203	116 (57.1)	67 (22-87)	150 (73.9)	108 (53.2)	NR	118 (58.1)	94 (46.3)	7 (3.4)	11 (5.4)	25 (12.3)	48 (23.6)
		Dalteparin, n = 203	98 (48.3)	67 (34-87)	145 (71.4)	105 (51.7)	NR	118 (58.1)	86 (42.4)	17 (8.4)	6 (3.0)	7 (3.5)	56 (27.6)
ADAM-VTE§	2020	Apixaban, n = 150	72 (48.0)	64 ± 11	81 (54.0)	NR	8 (5.3)	96 (64.0)	48 (32.0)	0 (0)	0 (0)	9 (6.2)	23 (15.9)
		Dalteparin, n = 150	73 (48.7)	64 ± 11	75 (50.0)	NR	12 (8.0)	97 (64.7)	57 (38.0)	5 (3.5)	2 (1.4)	7 (4.9)	15 (10.6)
CARAVAGGIO	2020	Apixaban, n = 576	292 (50.7)	67 ± 11	304 (52.8)	116 (20.1)	45 (7.8)	389 (67.5)	188 (32.6)	32 (5.6)	22 (3.8)	52 (9.0)	135 (23.4)
		Dalteparin, n = 579	276 (47.7)	67 ± 11	334 (57.7)	114 (19.7)	61 (10.5)	396 (68.4)	187 (32.3)	46 (7.9)	23 (4.0)	35 (6.0)	153 (26.4)

# Clinical impact of incidental or unsuspected PE

## Outcomes

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### Caravaggio 2020

MEDICINE

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**Table 3. Summary of findings for DOACs vs LMWHs for the treatment of cancer-associated thrombosis in patients with incidental VTE**

Outcome	No. of participants (studies)	Certainty of the evidence (GRADE)	RR (95% CI)	Observed risk with LMWH	Anticipated absolute effects	
					Risk with DOACs*	Absolute risk difference
Recurrent VTE	774 (3 RCTs)	⊕⊕⊕○ MODERATE due to imprecision†	0.54 (0.26 to 1.11)	6.4%	3.5%	-2.9% (-4.7 to 0.7)
Major bleeding	774 (3 RCTs)	⊕⊕⊕○ MODERATE due to imprecision†	1.29 (0.74 to 2.28)	4.6%	5.9%	1.3% (-1.2 to 5.9)

# Cancer-associated PE (acute symptomatic + unsuspected): The EIPHANY study

**N=1033 consecutive patients** cancer-associated PE (Acute symptomatic + Unsuspected)

Spanish multicenter observational - Ambispective recruitment

**58% unsuspected PE**

**Overall 30-day mortality rate 14%**

**Variables associated with the overall 30-day mortality** on multivariate analysis:

	<b>OR (95%CI)</b>	<b>p-value</b>
VTE history	2.178 (1.224-3.875)	0.008
Upper gastrointestinal cancers	2.429 (1.436-4.109)	0.001
Metastatic disease	2.756 (1.380-5.505)	0.004
Cancer progression	2.663 (1.729-4.100)	<0.001
Performance status $\geq 2$	3.528 (2.194-5.674)	<0.001
Arterial hypotension <100 mmHg	1.469 (1.009-3.103)	0.046
Heart rate $\geq 110$ beats·min <sup>-1</sup>	1.761 (1.065-2.912)	0.028
Basal oxygen saturation <90%	2.214 (1.364-3.596)	0.001
SPE (versus overall UPE)	1.978 (1.254-3.118)	0.003

# The EIPHANY index

Decision tree model aimed to predict serious complications within 15 days.

**Serious complications within 15 days: 19.3%** (95% CI); 17.1-21.8%)

**Overall mortality rate within 15 days: 10.1%** (95% CI, 8.4-12.1%).

	Low risk	Intermediate risk	High risk	
Serious complications within 15 days	1.6%	9.4%	30.6%	P<0.0001
Mortality rates within 15 days	0.3%	6.1%	17.1%	P<0.0001

Prognostic Tools

EIPHANY Calculator

Pulse >110 beats per minute  
Sudden or progressive dyspnea  
Other serious complications, constituting admission criteria in and of themselves  
Clinically relevant bleeding, high risk of bleeding, or platelets <50 000 mm<sup>-3</sup>.

Calculator

Step 1: Start calculator

At least one risk factor present

No risk factor present

### The EIPHANY index

**Clinical decision rule  $\geq 1$  (vs. none)**

- Systolic blood pressure <100 mmHg
- Arterial oxygen saturation <90%
- Respiratory rate  $\geq 30$
- Sudden or progressive dyspnea
- Other serious complications constituting admission criterio
- Clinically relevant bleeding, high risk of bleeding or platelet count <50000

**ECOG performance status  $\geq 2$  (vs. <2)**

- PE symptoms yes/no
- O2 saturation <90% (vs.  $\geq 90\%$ )
- Tumor response assessment
- Surgery of the primery tumour (yes/no)

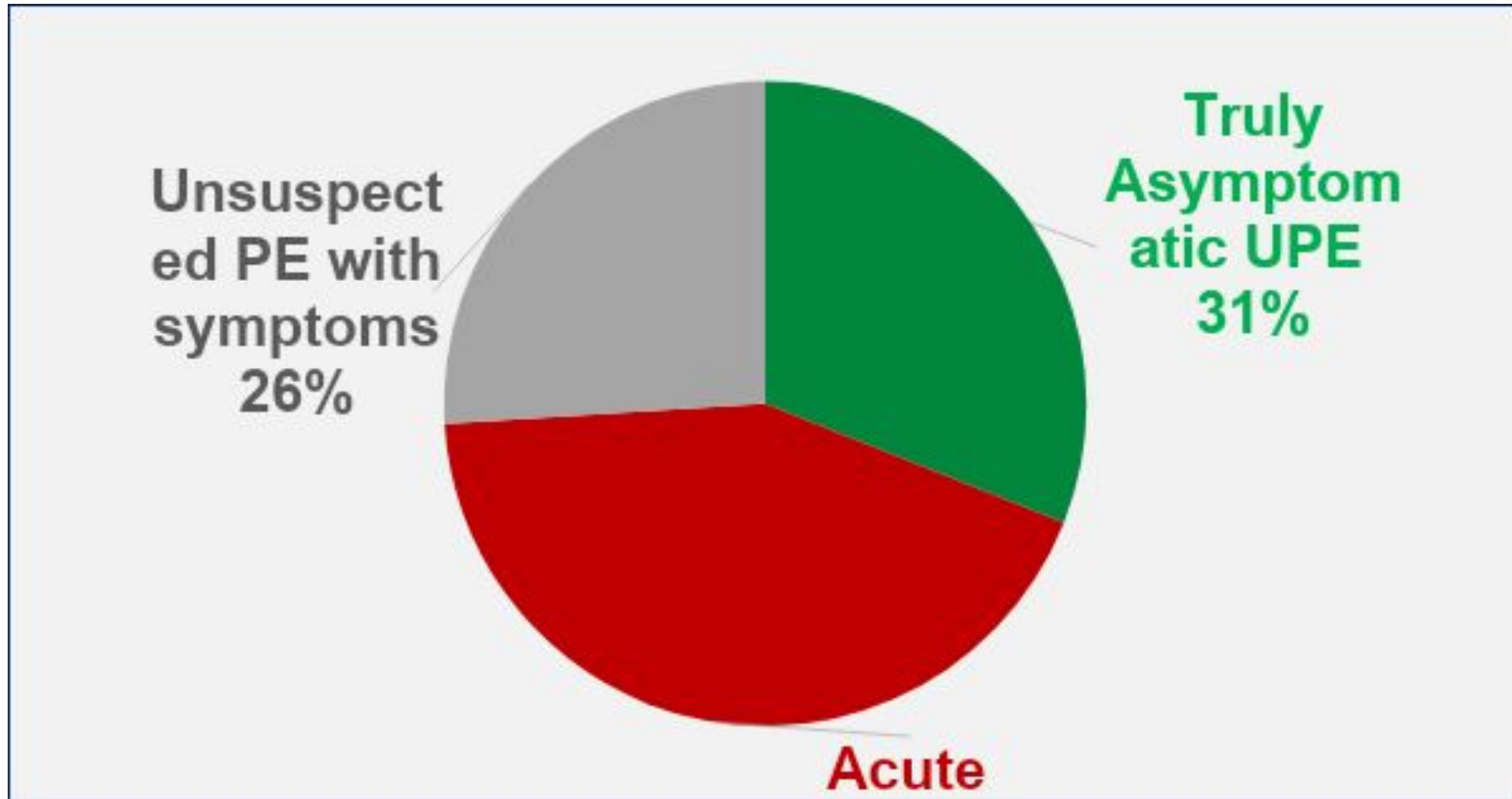
# Clinical scenarios in cancer patients with PE according to the '4S rule'

N=497 prospectively assessed patients

	Truly <u>Asymptomatic</u> Unsuspected PE (TAUPE)	Non-TAUPE	
		Acute Symptomatic PE	Unsuspected PE with Symptoms
<u>Setting</u> at PE diagnosis	Outpatient	Inpatient or Outpatient	Inpatient or Outpatient
PE <u>Suspicion</u>	no	yes	no
Vital <u>Signs</u>	Within normal limits: BP >100 mmHg HR < 100 x' O2 saturation >95%	any	any
<u>Symptoms</u>	no	yes	yes



**N=497 prospectively assessed patients**



# N=497 prospectively assessed patients

## Overall 30-day mortality:

**3%** in patients with Truly asymptomatic UPE

20% in UPE with symptoms (or inpatient)

**21% in SPE 21%** (p<0.0001)

Similar rates of Recurrent VTE and

Major bleeding at 30- and 90-days in all the groups.

Patients with truly asymptomatic events had a

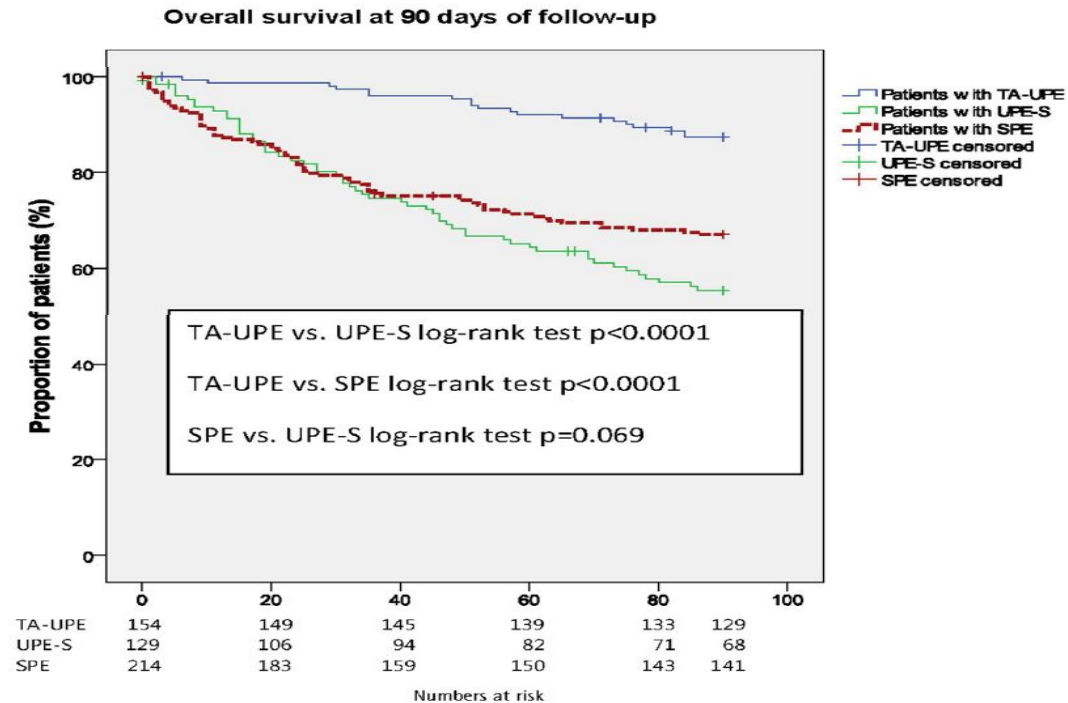
higher 90-day overall survival than

those with UPE-S (log-rank <0.001) and

with SPE (log-rank p<0.001).

The differences did not reach statistical significance on comparing

patients with UPE-S and SPE (log-rank p=0.069)



# Clinical impact of incidental PE: the RIETE Registry

## Clinical characteristics and 3-month outcomes in cancer patients with incidental vs. clinically suspected and confirmed PE

N=946 cancer patients with incidental asymptomatic PE

N=2274 with clinically suspected and confirmed PE

	Incidental asymptomatic PE	Acute symptomatic PE	
All cause mortality rate	11%	22%	OR 0.43, 95% CI 0.34-0.54
PE-related mortality	0.3%	1.7%	OR 0.18, 95% CI 0.06-0.59

There were no significant differences in PE recurrences (OR 0.62, 95% CI 0.25-1.54)

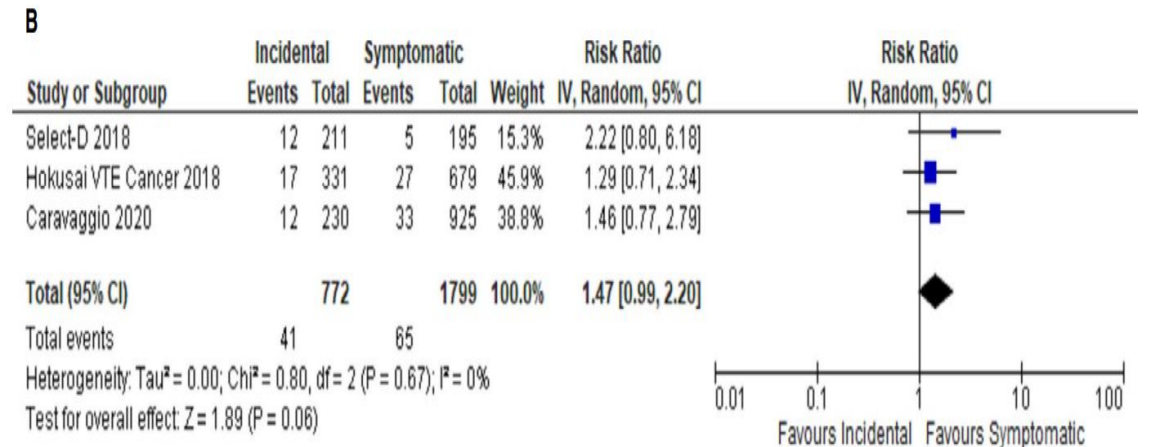
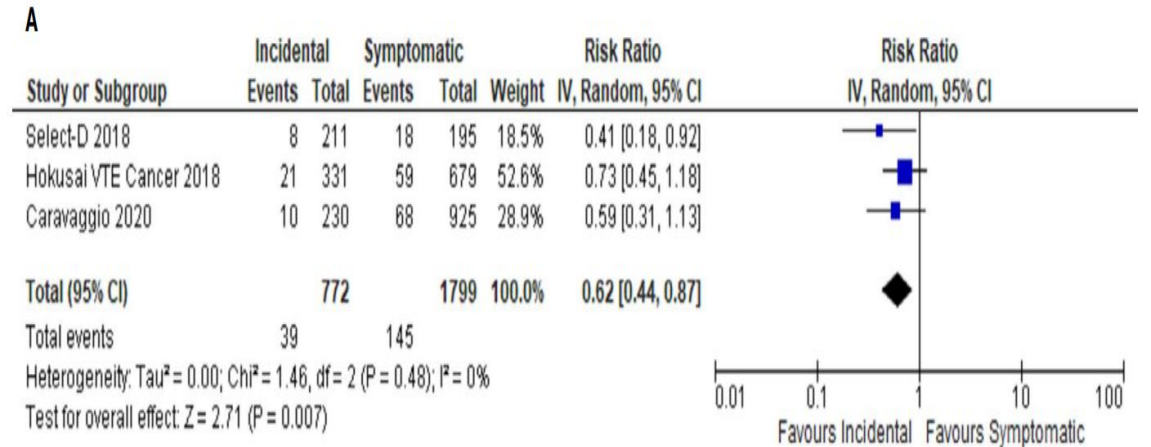
or major bleeding (OR 0.78, 95% CI

# Clinical impact of incidental or unsuspected PE

## Systematic review and meta-analysis

3 RCTs and 20 observational studies  
6 months follow-up

- Incidental VTE was associated with a **lower rate of VTE recurrence compared to symptomatic VTE (RR 0.62, 95%CI 0.44-0.87)**
- A trend in increased risk of major bleeding events is found in patients with incidental VTE (RR 1.47, 95% CI 0.99–2.20)
- No difference in overall mortality.
- The risk-benefit ratio of anticoagulation may differ between incidental and symptomatic events.



# Cancer-associated pulmonary embolism (PE)

## Outline

- Introduction
- Risk-assessment models for cancer-associated PE
- **Potential outpatient management in patients with cancer**
- Conclusions



# Outpatient management of pulmonary embolism?

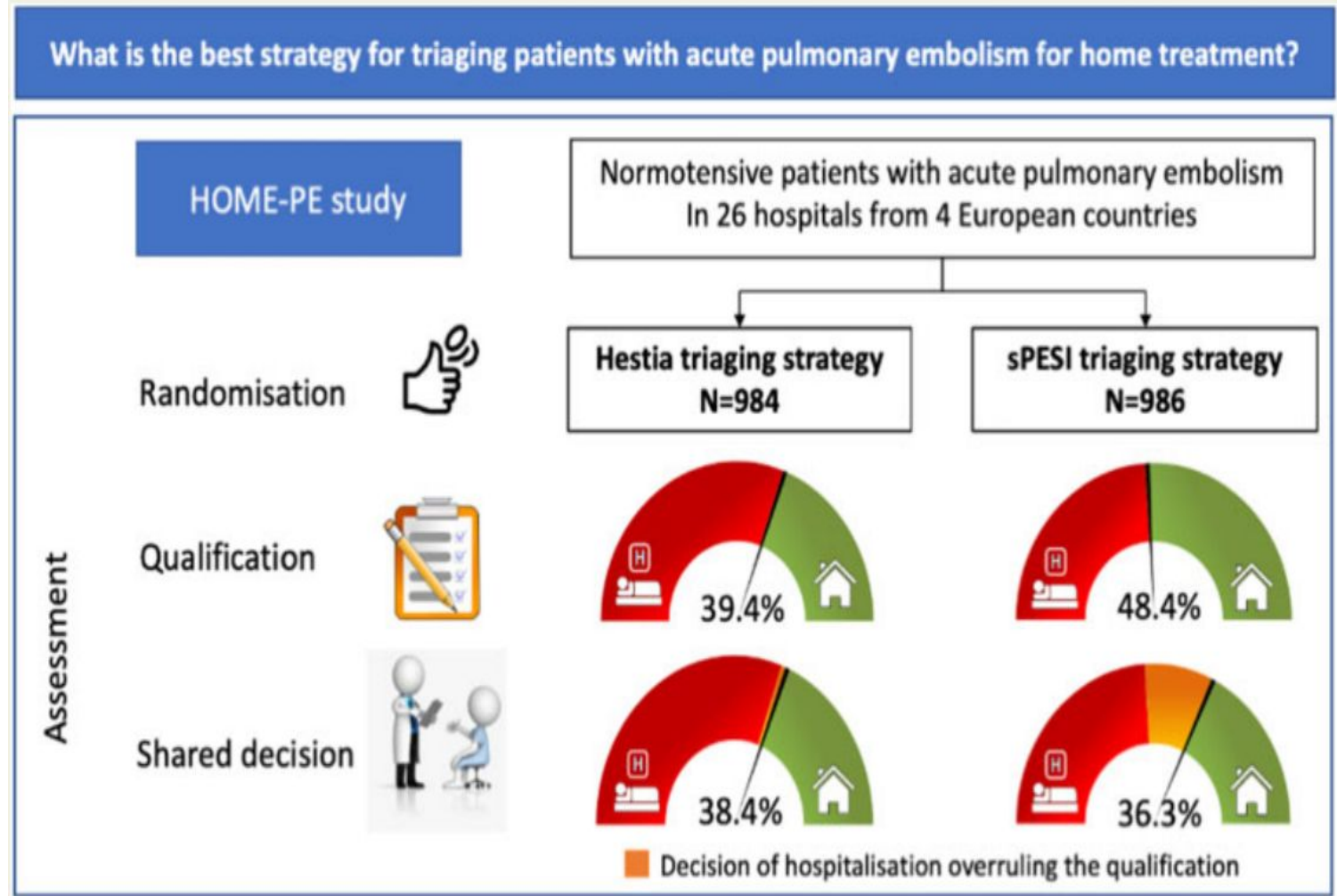
	Aujeski D et al Lancet 2011	Otero R et al Thromb Res 2010	Peacock FW et al Acad Emerg Med 2018	HOME-PE Roi PM et al Eur Hear J 2021
Design	Outpatient (discharge ≤24h) vs. inpatient	Early discharge (3-5 days) vs. Standard hospitalization	Outpatient (discharge ≤24h) with rivaroxaban vs standard of care	Compare the performance of two triage strategies (Hestia vs. sPESI)
Inclusion criteria	Clas I-II PESI score	Low-risk acute PE according to specific clinicak predictors	Hestia criteria	Normotensive patients with acute PE not candidates for hospital admission
Patients	N=171 outpatients vs. N=168 inpatients	N=72 early discharge vs. N=60 inpatients	N=51 outpatients vs. N=63 standard of care	N=984 Hestia rule vs. N=986 sPESI
<b>Patients with cancer</b>	<b>N=1 (1%) outpatients vs. N=3 (2%) inpatients</b>	<b>N=3 (5%) early discharge vs. N=3 (4.2%) hospitalized</b>	<b>N=3 (5.9%) outpatients vs. N=4 (6.3%) standard of care</b>	<b>N=148 (15.1%) Hestia vs. N=101 (10.3%) sPESI</b>

# The HOME-PE randomized trial

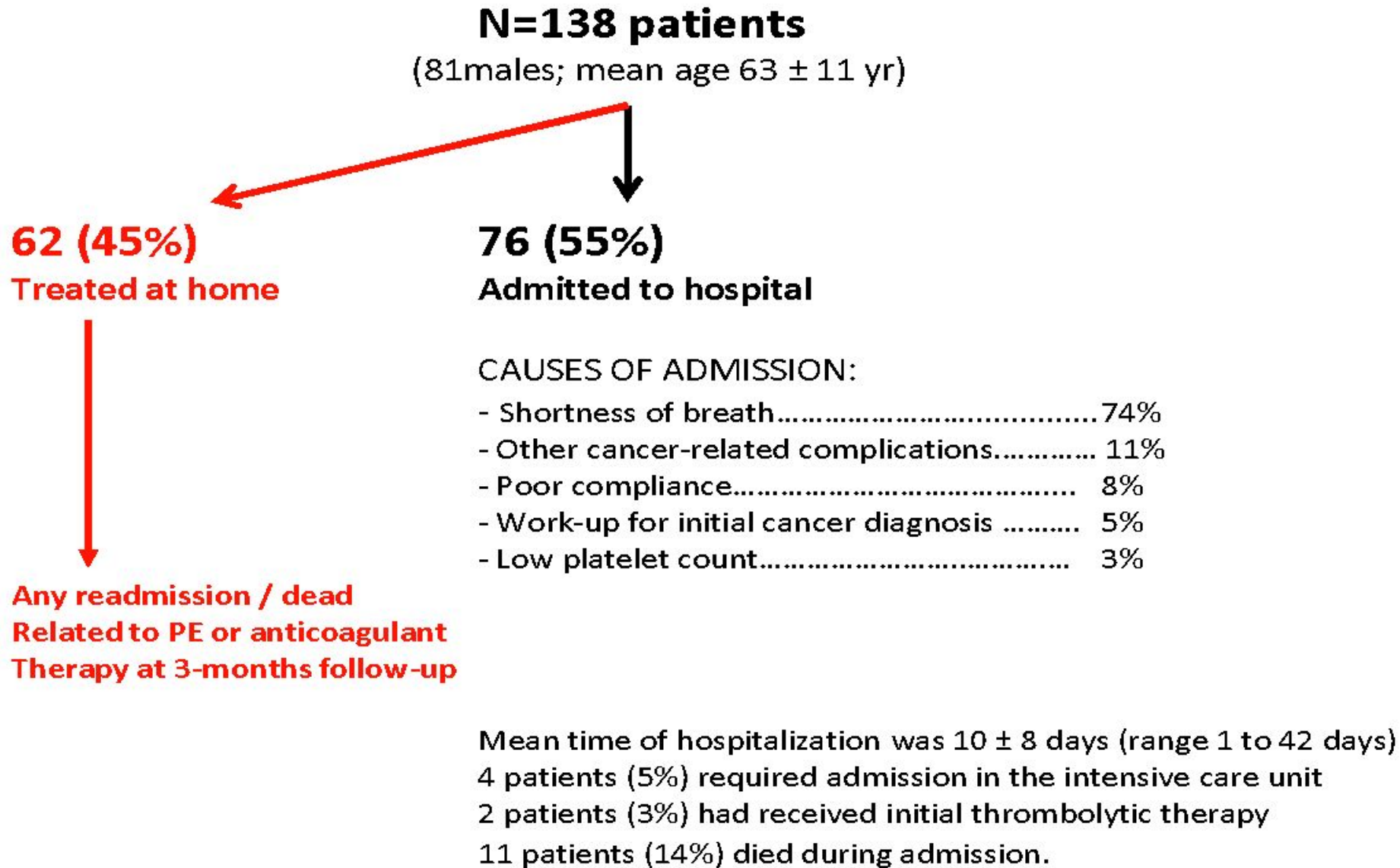
## Triaging acute pulmonary embolism for home treatment by Hestia or simplified PESI criteria: the HOME-PE randomized trial

sPESI criteria	Points
Age >80 years	1
History of cancer	1
Chronic cardiopulmonary disease	1
Systolic blood pressure <100 mmHg	1
Heart rate ≥110 b.p.m.	1
Arterial oxygen saturation <90%	1

Checklist questions of the Hestia rule
• Is the patient haemodynamically unstable? <sup>a</sup>
• Is thrombolysis or embolectomy necessary?
• Active bleeding or high risk of bleeding? <sup>b</sup>
• More than 24 h of oxygen supply to maintain oxygen saturation >90%?
• Is pulmonary embolism diagnosed during anticoagulant treatment?
• Severe pain needing intravenous pain medication for more than 24 h?
• Medical or social reason for treatment in the hospital for more than 24 h. (infection, malignancy, no support system)?
• Does the patient have a creatinine clearance of <30 mL/min? <sup>c</sup>
• Does the patient have severe liver impairment? <sup>d</sup>
• Is the patient pregnant?
• Does the patient have a documented history of heparin-induced thrombocytopenia?



# Outpatient management of patients with cancer-associated PE



# 2019 ERS/ESC recommendations for the management of 'low-risk' PE

**Early discharge** of a patient with acute PE and continuation of anticoagulant treatment at home should be **considered if three sets of criteria** are fulfilled:

- **the risk of early PE-related death or serious complications is low**
- there is **no serious comorbidity** or aggravating condition(s) that would mandate hospitalization
- **proper outpatient care** and anticoagulant treatment can be provided, considering the patient's (anticipated) compliance, and the possibilities offered by the healthcare system and social infrastructure.

The **Hestia rule** and the **PESI or sPESI (combined with assessment of the feasibility of early discharge)** appear either may be used for clinical triage according to local experience and preference.

# Factors potentially favoring outpatient management according to case-by-case in patients with cancer-related PE

	Hospitalization with early discharge or outpatient management	Hospitalization
PE-related to clinical severity	<ul style="list-style-type: none"> <li>- Asymptomatic</li> <li>- Minor symptoms (e.g., cough)</li> <li>- Unsuspected or incidental PE</li> <li>- Vital signs within normal limits</li> </ul>	<ul style="list-style-type: none"> <li>- Hemodynamic instability:               <ul style="list-style-type: none"> <li>· Arterial hypotension systolic BP &lt; 100 mmHg</li> <li>· Tachycardia (HR &gt; 100 bpm)</li> <li>· Signs of RV dysfunction</li> <li>· Oxygen saturation &lt; 95%</li> </ul> </li> <li>- Uncontrolled potentially life-threatening symptoms:               <ul style="list-style-type: none"> <li>· Dyspnea</li> <li>· Chest pain</li> <li>· Hemoptysis</li> </ul> </li> <li>- Concomitant proximal DVT</li> </ul>
Bleeding concerns	None	<ul style="list-style-type: none"> <li>- Active bleeding</li> <li>- High risk of bleeding</li> <li>- Thrombocytopenia &lt; 50,000/uL</li> <li>- Contraindications for anticoagulation</li> </ul>
Cancer-related conditions	None	<ul style="list-style-type: none"> <li>- Uncontrolled cancer-related symptoms</li> <li>- Initial cancer evaluation requiring invasive tests</li> <li>- Concomitant cancer-related complications</li> <li>- Cancer progression requiring additional tests or specific therapies</li> </ul>
Other comorbidities	None relevant	<ul style="list-style-type: none"> <li>- Concomitant medical complications requiring inpatient management according to clinical judgment and supervision by a senior physician</li> <li>- Pregnancy</li> </ul>
Supportive health care facilities	<ul style="list-style-type: none"> <li>- Specialized outpatient clinics for follow-up</li> <li>- Home hospitalization programs</li> <li>- Home palliative/supportive care</li> <li>- Short-term ED observation areas</li> <li>- Senior clinician supervision</li> </ul>	<ul style="list-style-type: none"> <li>- No possibility of adequate PE monitoring after discharge</li> </ul>
Patient-related psychosocial issues	<ul style="list-style-type: none"> <li>- Patient preferences</li> </ul>	<ul style="list-style-type: none"> <li>- Patient preferences</li> <li>- Lack of caregiver or social support</li> <li>- Difficulty of follow-up due to geographical issues</li> </ul>

# Cancer-associated pulmonary embolism (PE)

## Outline

- Introduction
- Risk-assessment models for cancer-associated PE
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- **Conclusions**



# Conclusions I

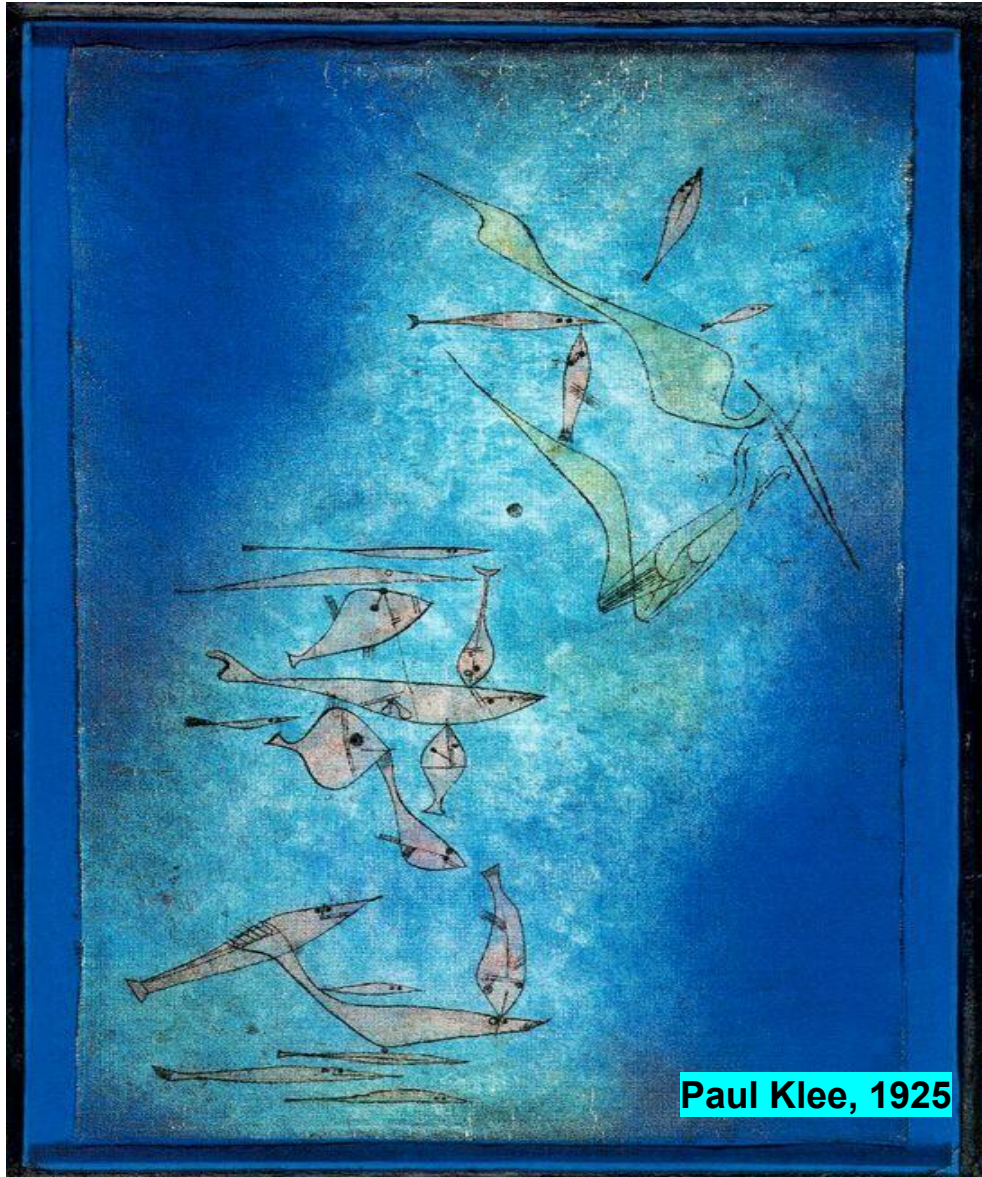
- **Patients with cancer have an increased risk of adverse outcomes** compared to the general population with acute PE.
- The overall **short term mortality** in cancer patients with PE is **high**.
- It is unclear if it is related to the PE itself (severity, limitations in the access to ICU admission or reperfusion therapy), concomitant bleeding and/or other complications of cancer (poor ECOG performance status, overlapping symptoms).

## Conclusions II

- Incidental PE **accounts for up to 50%** of PE diagnoses in cancer patients.
- The presence of **symptoms and the performance status** correlated with risk of death.
- Current clinical **guidelines recommend treating** incidental PE in the same manner as symptomatic PE.

## Conclusions III

- **Noble risk-assessment models for patients with cancer-associated PE** have been developed.
- They might be useful for risk-stratifying patients in prospective interventional trials aimed to:
  - ✓ Select patients for outpatient management.
  - ✓ Assess the optimal '3D' anticoagulation (drug, dose, duration) in patients with acute symptomatic or unsuspected PE .



Paul Klee, 1925

# Thank you!

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