



Embolie Pulmonaire

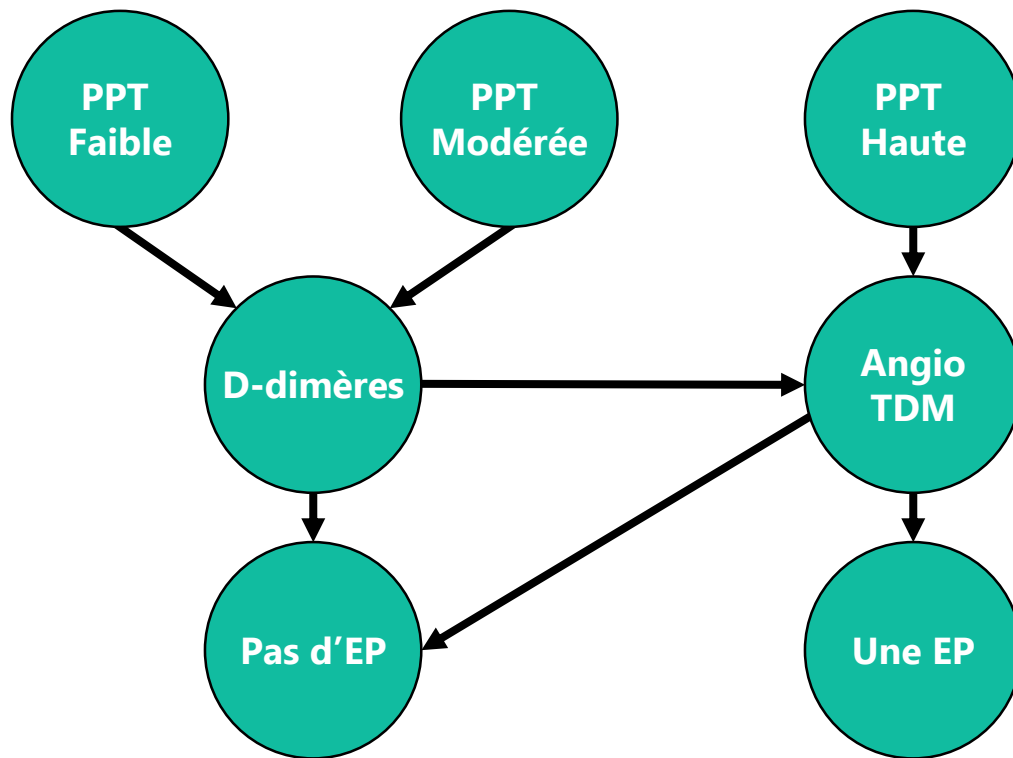
Strategie diagnostique optimale pour le patient

IMPEC  Improving
emergency
care

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Sorbonne Université - Hôpital Pitié-Salpêtrière

11 mai 2023

Stratégie diagnostique



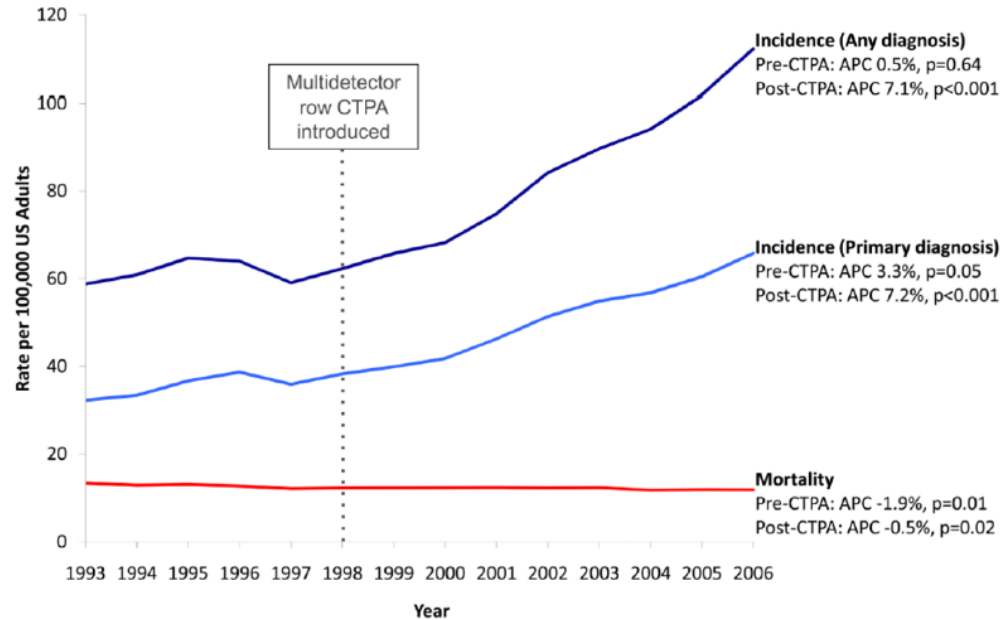
Le problème



Le mythe

Une EP loupée => un patient tué

When a test is too good



Overdiagnosis

***On diagnostique + d'EP
sans amélioration pronostique***

Pourquoi une telle explosion de diag?

Patient Stories



Steve Brenner

Steve Brenner passed away from a pulmonary embolism in August of 2016. His wife, Michele Brenner, shares his story: My husband, Steve Brenner, died of a massive pulmonary embolism on...

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Peter Donati

Peter is an avid athlete, who enjoys swimming and running, a family man, and a professional. After experiencing a PE, he found himself with a lot of questions about...

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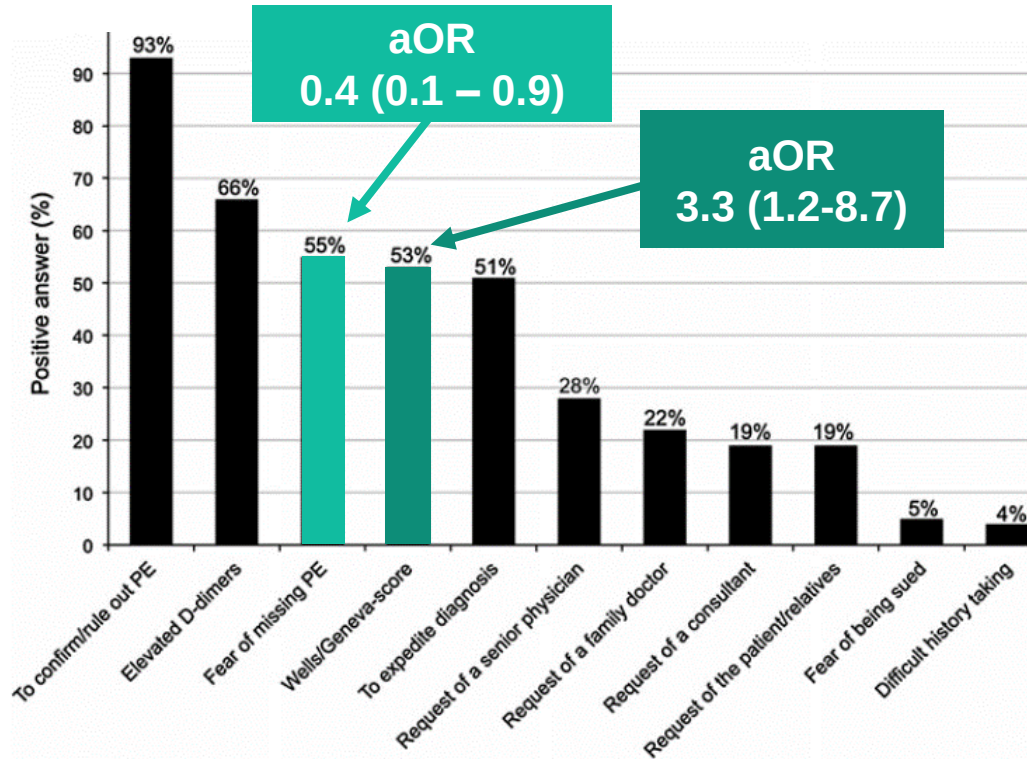


Bart Coyne

Bart Coyne, a heart transplant patient, experienced deep vein thrombosis (DVT) and pulmonary embolism (PE) in April 2017. Here is his story about how a positive attitude and the support...

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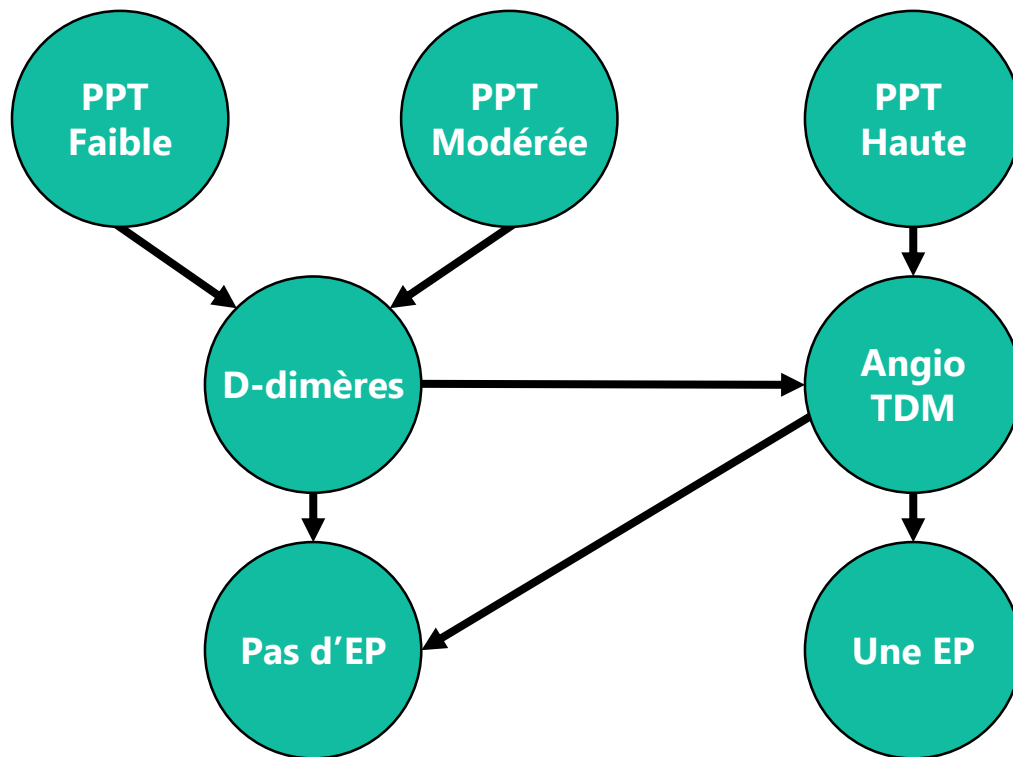
Fear directed strategy



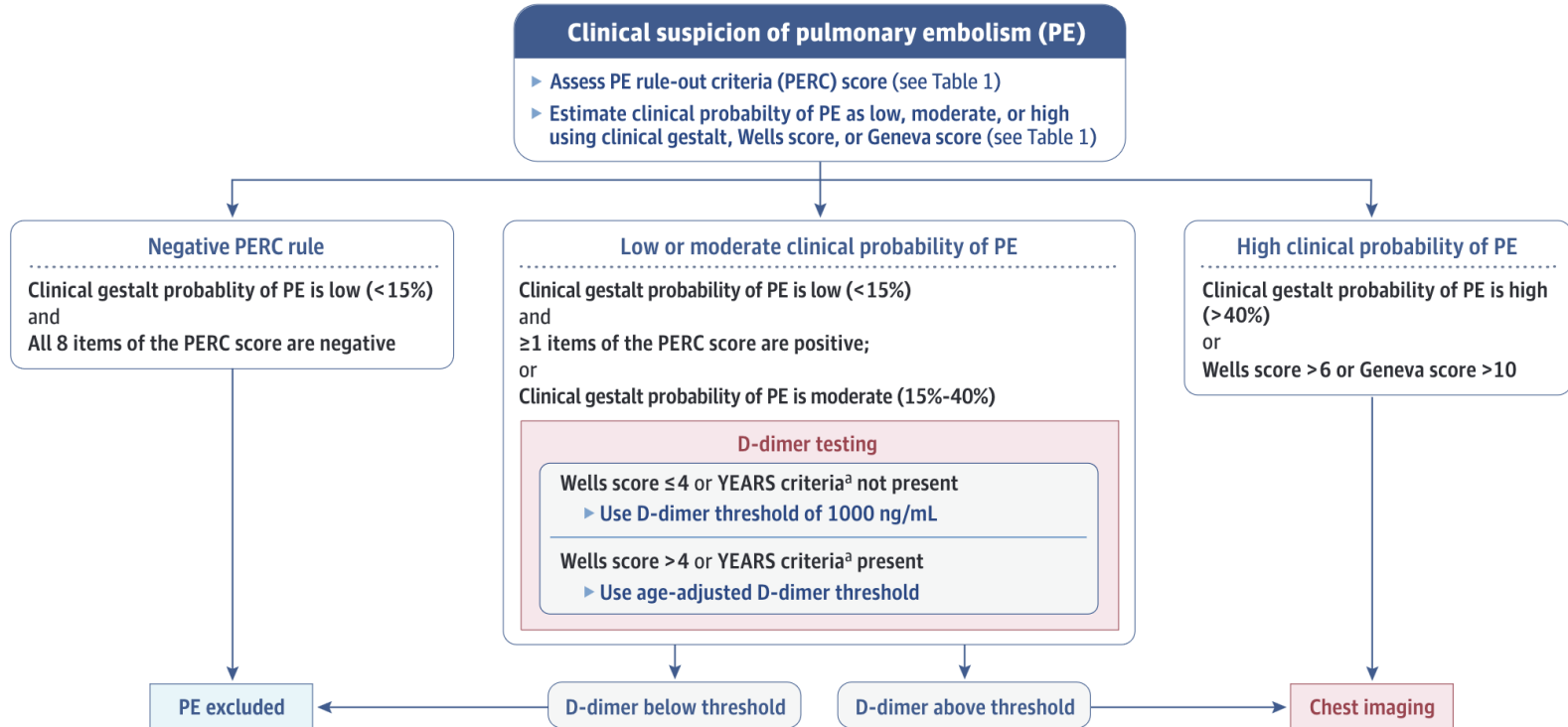
A 3D medical illustration of a blood vessel. The vessel is shown in cross-section, with a red outer wall and a blue inner lumen. A large, irregular, orange-brown plaque is attached to the inner wall, partially obstructing the flow. Numerous red blood cells, depicted as red discs, are shown flowing through the vessel. Some are clustered near the plaque, while others are further downstream. The overall scene is set against a dark background.

Le diagnostic!

Stratégie diagnostique



Stratégie diagnostique



Scanner guidé par

- D-dimères: Bonne VPN
- VPN dépend de la prévalence
- Bien pour l'exclusion sauf en cas de haute prévalence!

Pre test probability
(clinical probability)

Clinical probability



wells

Table 1. Wells clinical prediction score (14)

Characteristics	Score
Previous pulmonary embolism or deep vein thrombosis	1.5
Heart rate > 100 beats/minute	1.5
Recent surgery or immobilization	1.5
Clinical signs of deep vein thrombosis	3
Alternative diagnosis less likely than pulmonary embolism	3
Hemoptysis	1
Cancer	1
Interpretation:	
Low probability: 0-1 points	
Intermediate probability: 2-6 points	
High probability: 7 or more	



Geneve

Variable	Score
Age 65 years or over	1
Previous DVT or PE	3
Surgery or fracture within 1 month	2
Active malignant condition	2
Unilateral lower limb pain	3
Haemoptysis	2
Heart rate 75–94 beats per minute	3
Heart rate 95 or more beats per minute	5
Pain on deep palpation of lower limb and unilateral edema	4

0–3 Points indicates low probability.

4–10 Points indicates intermediate probability.

11 Points or more indicates high probability.



Clinical probability



**La Gestalt est une approche
humaniste et existentielle.**

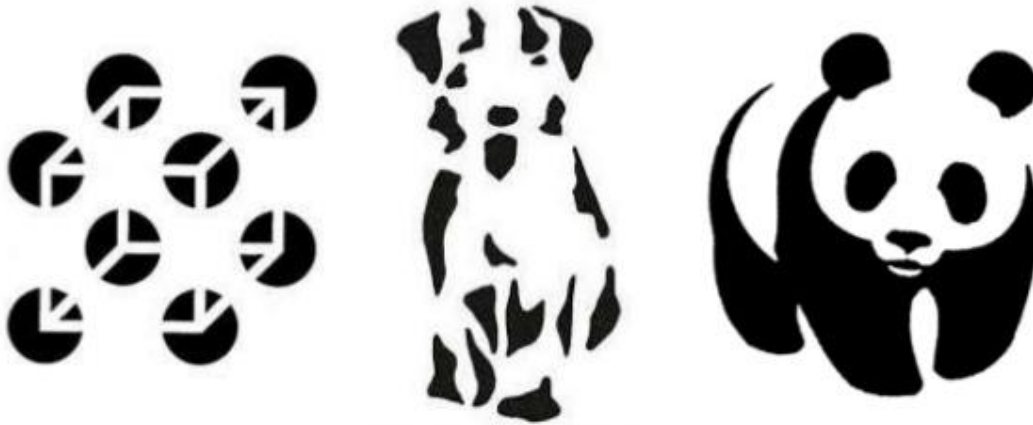
**Elle intègre comment nous créons
du sens dans l'instant présent,
c'est à dire la globalité de notre corps,
nos pensées et nos émotions.**

**Elle permet de créer des choix
pour une vie meilleure.**



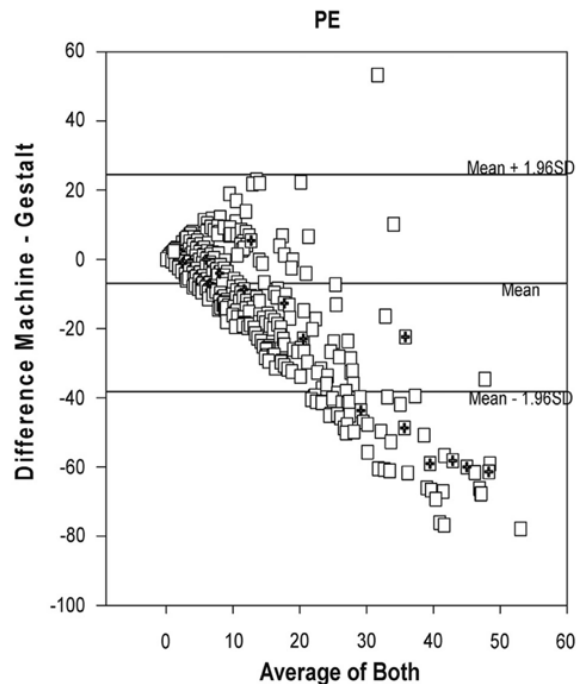
Gestalt

« The whole is not the sum of its parts, but greater »



Le jugement clinique ne saurait être remplacé par un score.
Mais devrait être utilisé en association à un système validé.

Gestalt



AUC Gestalt pour EP
0.81

Consultant ~ intern

Gestalt



Je pense que ce patient a une faible probabilité d'EP?



Prévalence < 5%

Comment reduire le recours a l'angioTDM

Pas beaucoup de possibilités

- Ne pas prescrire de D-dimères
- Modifier le seuil

Le gourou et sa philosophie



L'EP tue mais le scan aussi

- Irradiation
- AKI
- Faux positifs
- Surcharge urgences

Comment réduire le nb de scan demandés

Sans tuer trop de malades...

La balance

$$T_t = (P_{\text{pos/nd}} \times R_{\text{rx}} + R_t)(P_{\text{pos/nd}} \times R_{\text{rx}} + P_{\text{pos/d}} + B_{\text{rx}})$$

$$\begin{aligned} T_t &= (0.1 \times 0.017 + 0.000006) / (0.1 \times 0.017 + 0.85 \times 0.15) \\ &= 1.8\% \end{aligned}$$

Risques > bénéfices si prevalence <1.8%

Dérivation du score PERC

- Age < 50
- HR < 100
- Sat > 94%
- No oestrogen
- No recent surgery
- No Hx of thrombosis
- No hemoptysis
- No sign of DVT

**25% PERC négatif:
< 1 % d'EP!**

Résultats principaux

Intention-to-treat population, No. ^a	962	954			
CTPA performed	129 (13)	220 (23)	9.7 (6.1 to 13.2)	10	<.001
Length of ED stay, median (IQR), h:min	4:36 (3:16 to 6:21)	5:14 (3:50 to 7:18)	-00:36 (-1:08 to -0:04)		<.001
Hospital admission	121 (13)	152 (16)	3.3 (0.1 to 6.6)	30	.04
Anticoagulation therapy introduced	21 (2)	33 (3)	1.3 (0.3 to 2.9)	78	.09
Hospital readmission at 3 mo	43 (4)	62 (7)	2.1 (-0.1 to 4.3)	48	.051
All-cause death at 3 mo	3 (0.3)	2 (0.2)	0.1 (-0.5 to 0.7)		>.99

Réduction scan: RR 42% (29 – 52) / NNT = 10

Conclusion

La règle PERC marche

Suspicion
EP

+

Proba
faible

+

PERC à 0

= 0 EP

Seuil D-dimères

Age-Adjusted D-Dimer Cutoff Levels
to Rule Out Pulmonary Embolism
The ADJUST-PE Study

Monter le seuil des D-dimères sans rater trop d'EP?

Test du seuil $\text{Age} \times 10$

Ajusté à l'âge

337 patients Ddimeres > 500 mais < $\hat{\text{age}} \times 10$

1 seule EP non fatale (taux d'erreur 0,3%)

Aller plus loin

EP diagnostic + probable
Hemoptysie
Signes de TVP

NON

**Seuil D-dimères
1000 et pas 500**



Simplified diagnostic management of suspected pulmonary embolism (the YEARS study): a prospective, multicentre, cohort study



Réduction de 14% des TDM, <1% d'EP ratées

Validation 2019...



QUESTION Among ED patients with suspected pulmonary embolism (PE) not ruled out by the PE rule-out criteria (PERC) rule, does a diagnostic strategy that combines the YEARS rule and age-adjusted D-dimer threshold safely exclude the diagnosis of venous thromboembolism?

CONCLUSION In this cluster-randomized crossover noninferiority trial studying PERC-positive patients with suspected PE, YEARS rule combined with age-adjusted D-dimer threshold did not lead to an inferior rate of thromboembolic events vs a conventional diagnostic strategy.

POPULATION

823 Women
591 Men



Adults who had a low clinical risk of PE not excluded by the PERC rule or a subjective clinical intermediate risk of PE

Mean age: 55 years

LOCATIONS

18 Emergency departments in France and Spain



INTERVENTION



18 Centers randomized
1414 Patients randomized
1271 Patients analyzed

726

Intervention

Diagnostic strategy involved both an assessment of the YEARS criteria and D-dimer testing

688

Control

D-dimer testing with the threshold set at the age-adjusted level

PRIMARY OUTCOMES

Venous thromboembolism at 3 months

FINDINGS

Patients with venous thromboembolism at 3 months

Intervention

1 of 648 patients

0.15%

(95% CI, 0.0% to 0.86%)

Control

5 of 623 patients

0.80%

(95% CI, 0.26% to 1.86%)

Noninferiority margin, 1.35%

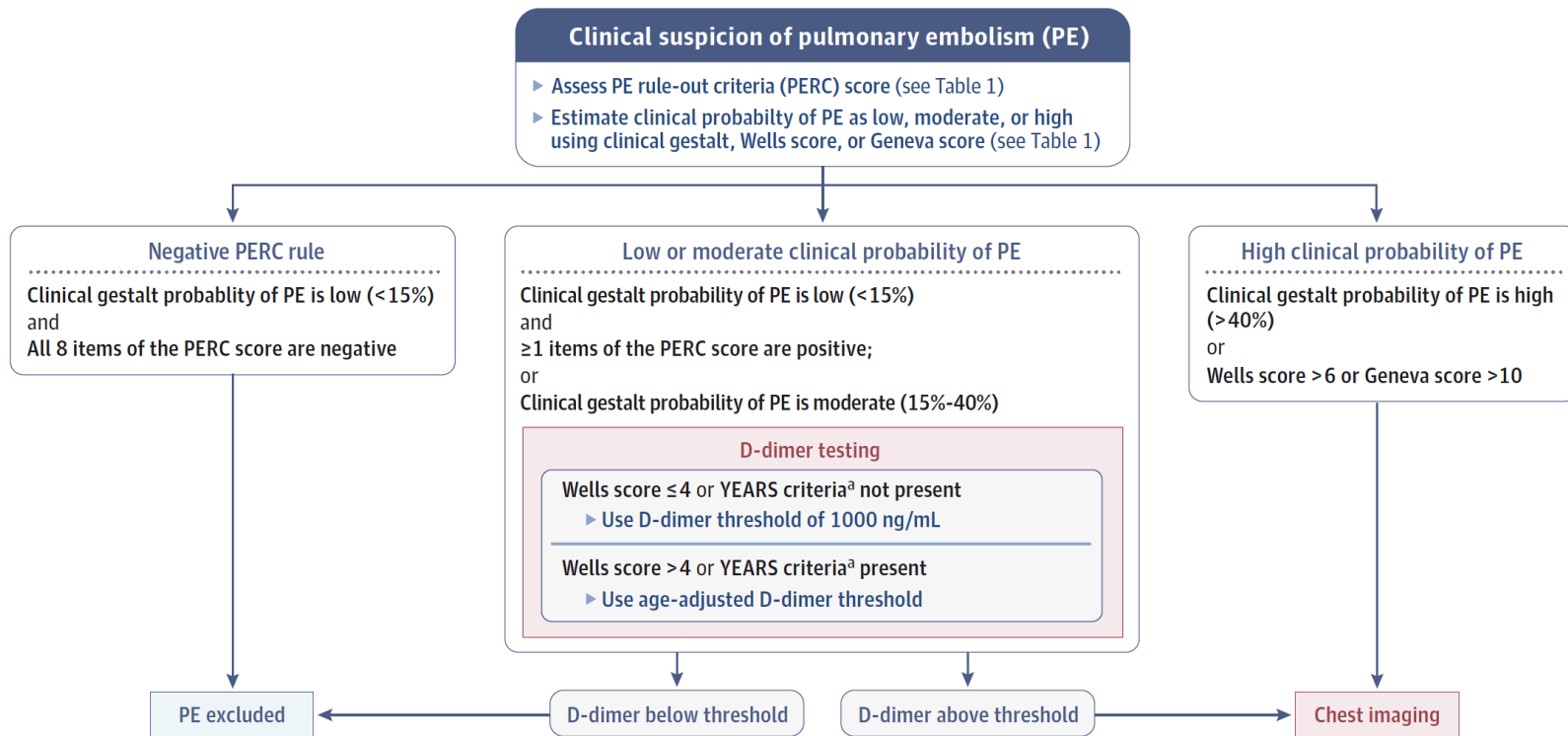
The results were within the noninferiority margin:

Adjusted difference, **-0.64%**
(1-sided 97.5% CI, -∞ to 0.21%)

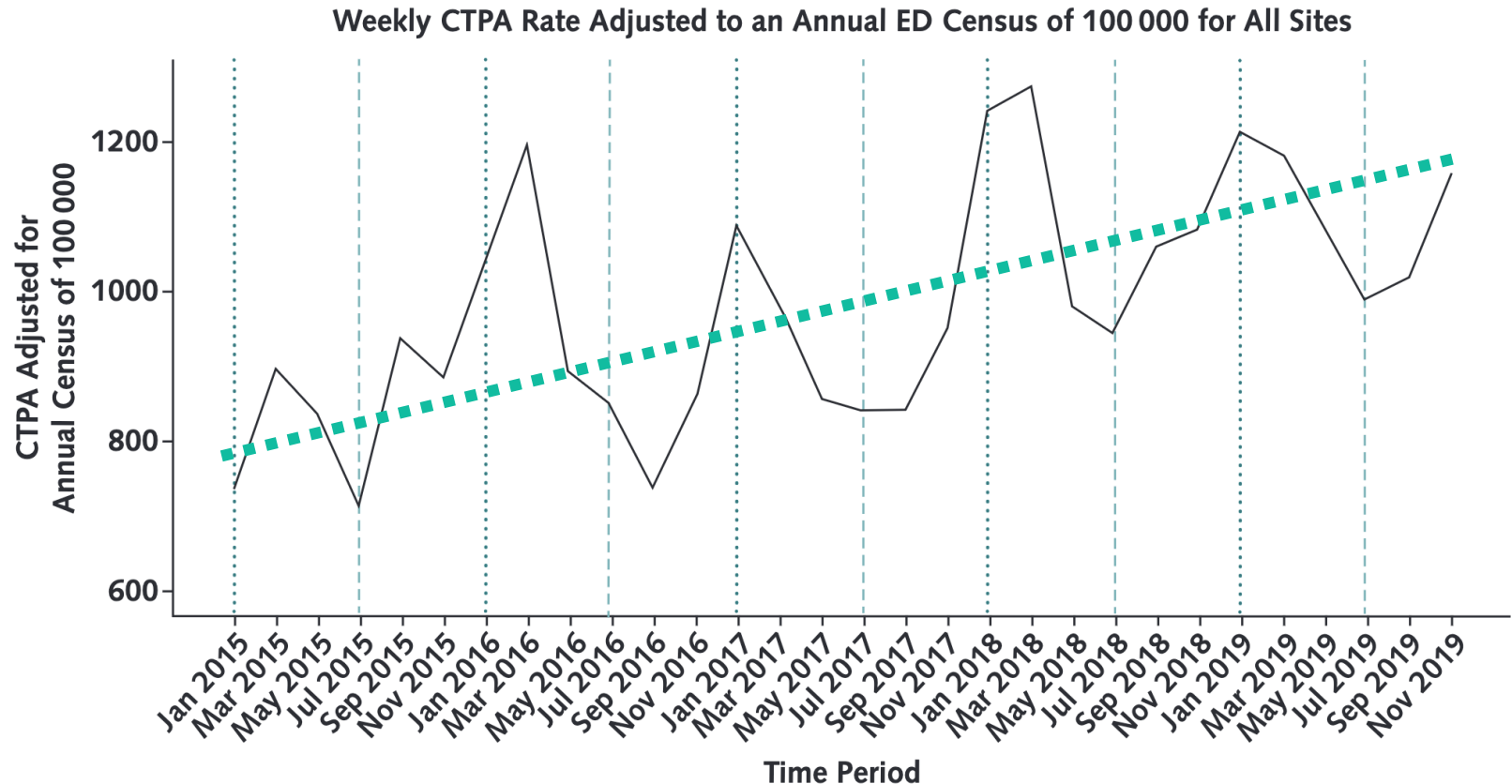
© AMA

Freund Y, Chauvin A, Jimenez S, et al. Effect of a diagnostic strategy using an elevated and age-adjusted D-dimer threshold in thromboembolic events in emergency department patients with suspected pulmonary embolism: a randomized clinical trial. *JAMA*. Published December 7, 2021. doi:10.1001/jama.2021.20750

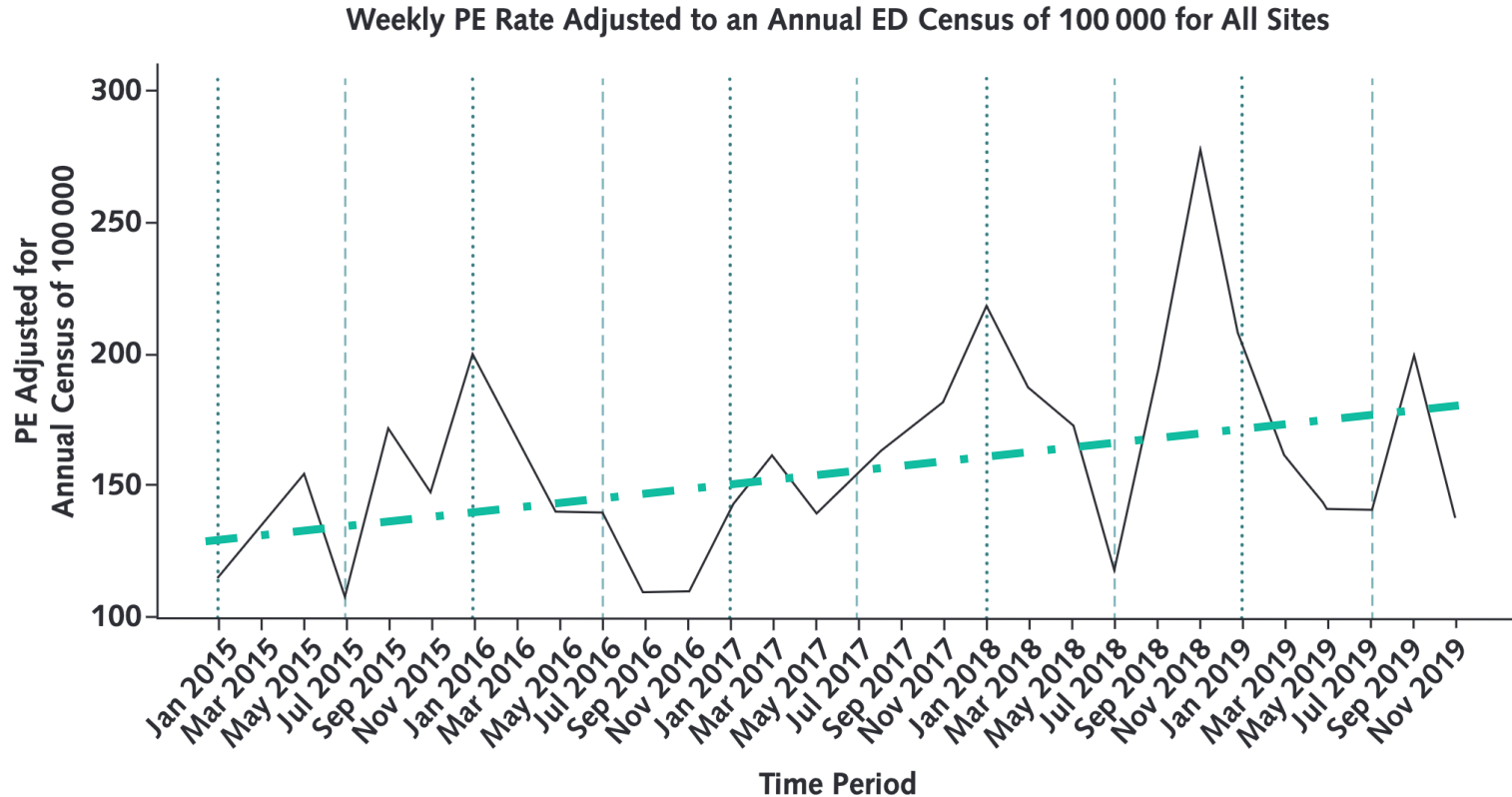
Stratégie globale



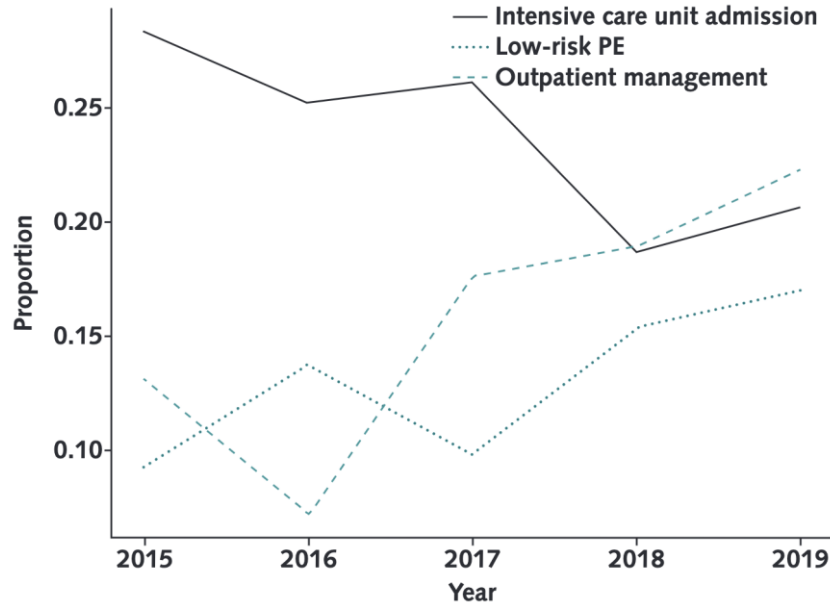
Et maintenant? On fait quand même + de scanners



Efficacité? On diagnostique un tout petit + d'EP



Et du point de vue du malade?



+ d'EP faible risque

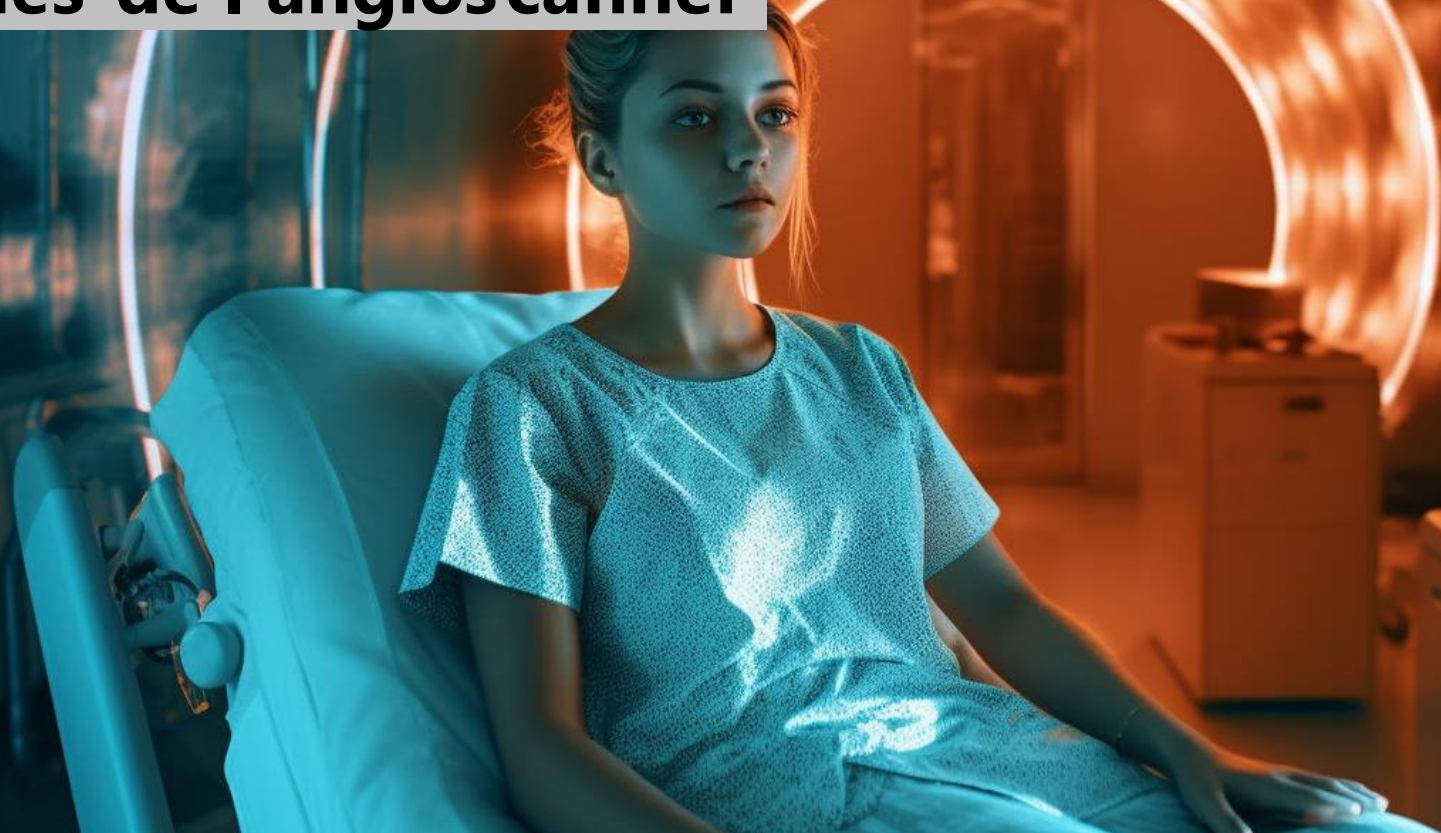
+ d'EP sous-segmentaire

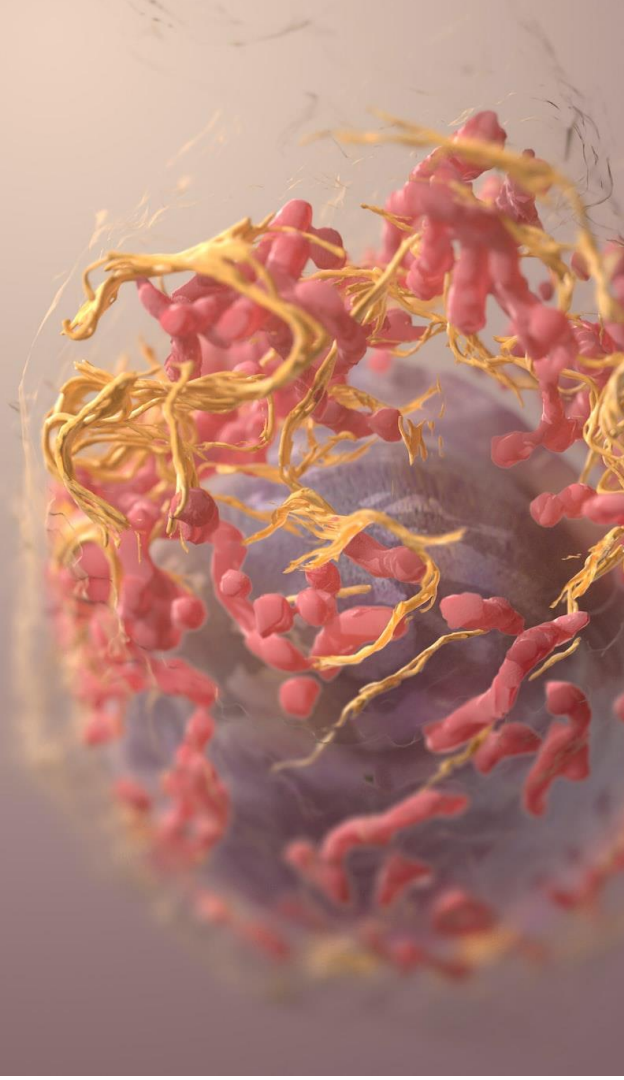
+ d'EP ambulatoires

- d'EP en réa

Et du point de vue du malade?

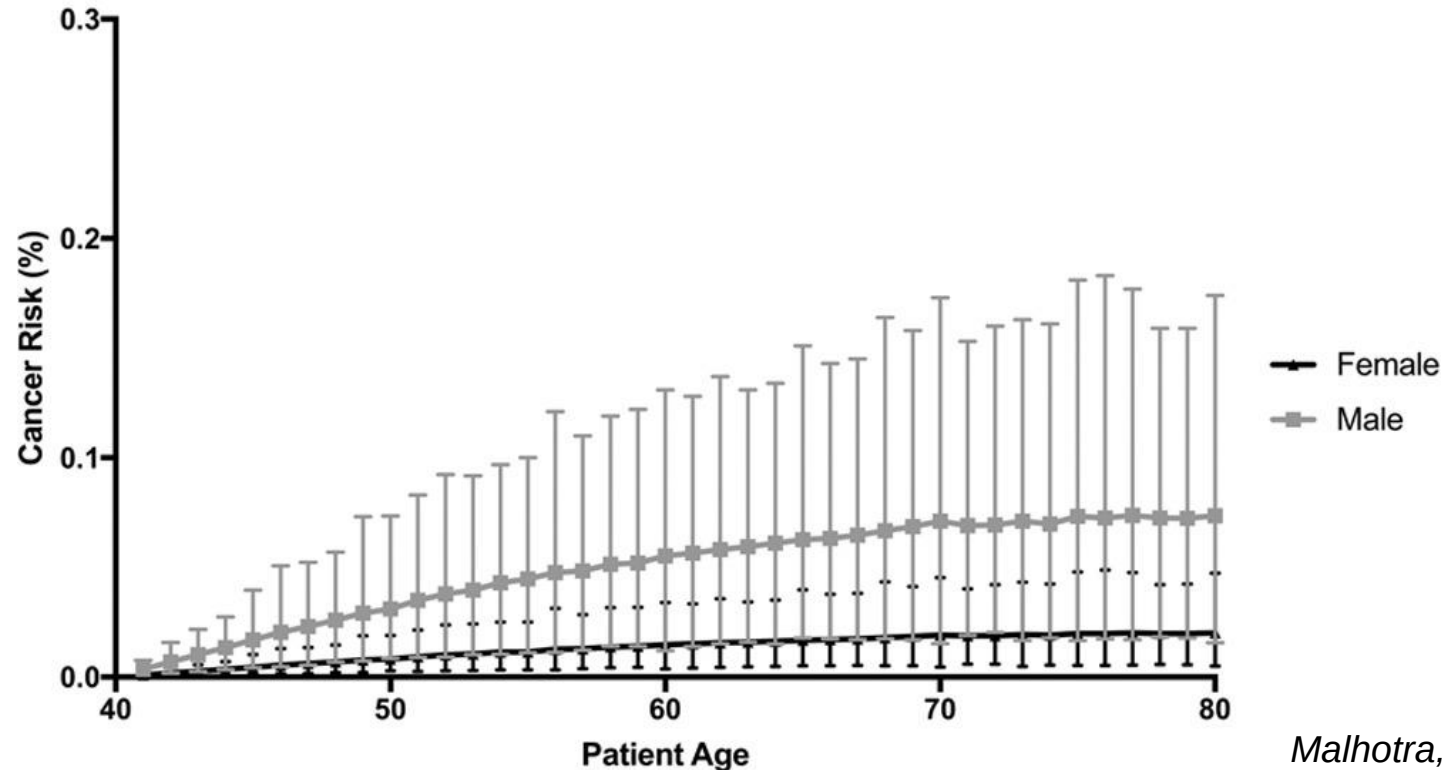
Risques de l'angioscanner



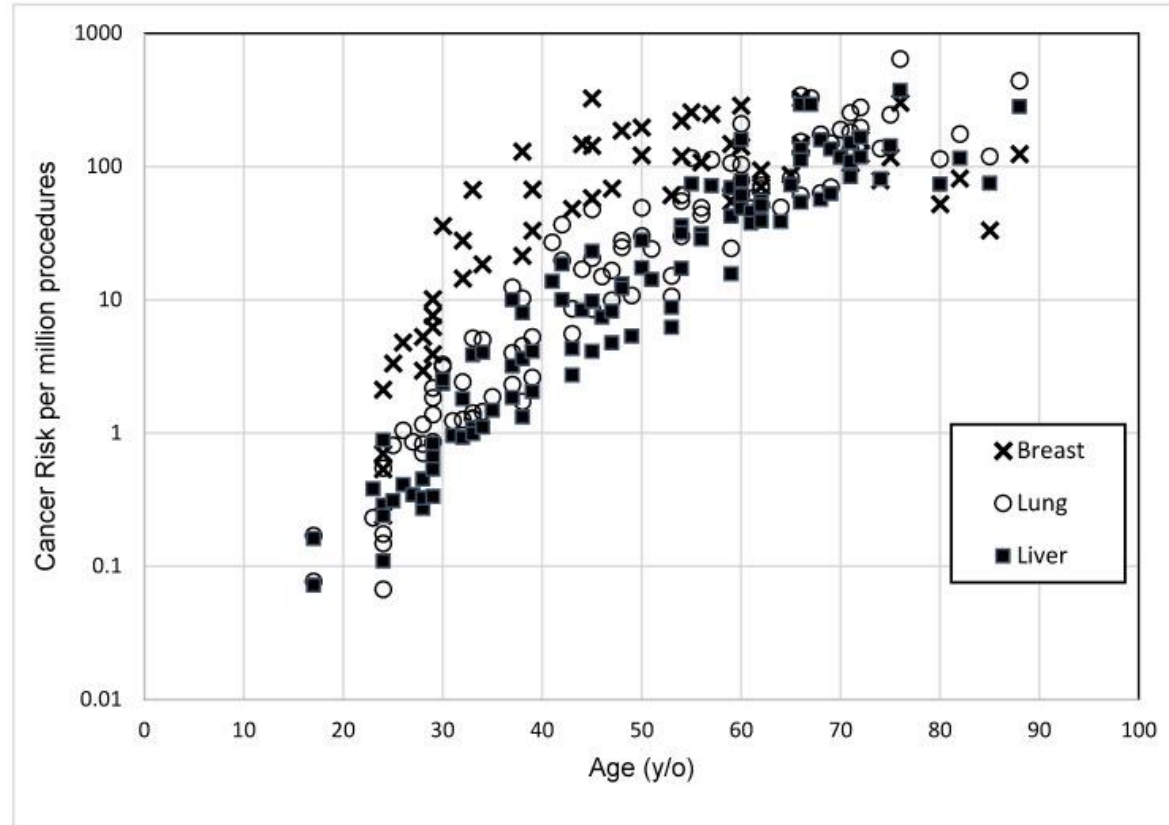


Surrisque de cancer?

Excess Lifetime Cancer Risk of 40-Year Old Patient Receiving Annual CTA

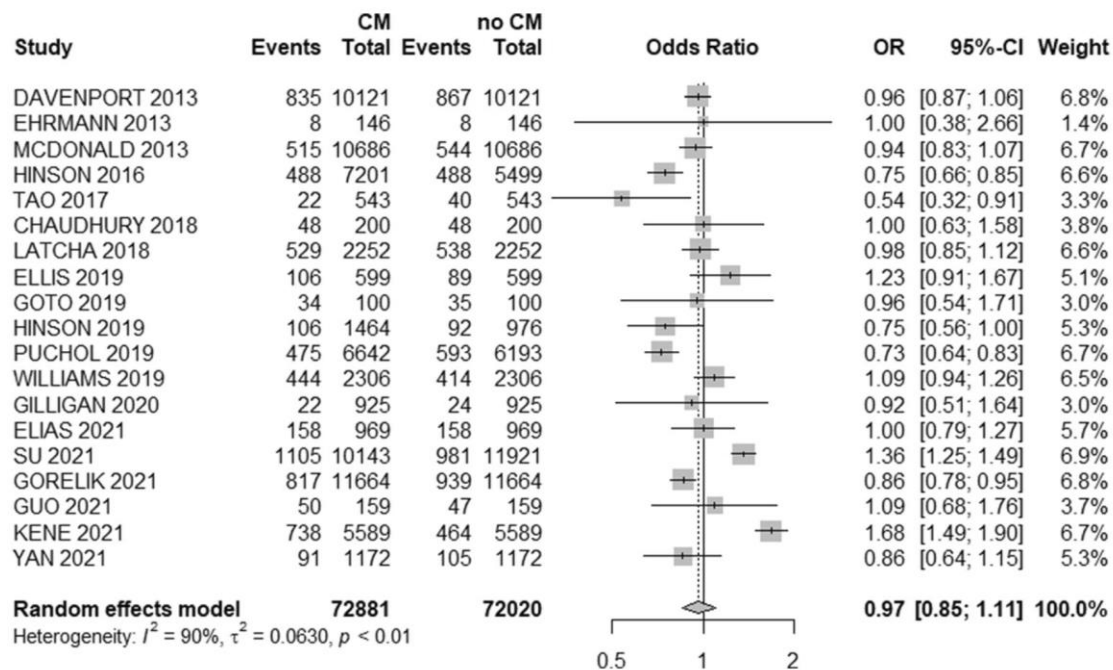


Surrisque de cancer?



Insuffisance rénale?

Fig. 2 Forest plot with overall odds ratio (OR) of the association of CM application and AKI. 95%-CI, 95% confidence interval; CM, contrast media



Anaphylaxie?

Radiology

ORIGINAL RESEARCH • CONTRAST MEDIA

Hypersensitivity Reactions to Iodinated Contrast Media: A Multicenter Study of 196 081 Patients

Min Jae Cha, MD • Dong Yoon Kang, MD* • Whal Lee, MD, PhD • Soon Ho Yoon, MD • Young Hun Choi, MD •
Jun Soo Byun, MD, PhD • Jongmin Lee, MD, PhD • Yun-Hyeon Kim, MD, PhD • Ki Seok Choo, MD, PhD •
Bum Sang Cho, MD • Kyung Nyeo Jeon, MD, PhD • Jae-Woo Jung, MD, PhD • Hye-Ryun Kang, MD, PhD*

1 effet indésirable grave pour 10 000 AngioTDM

**Balance plutôt à l'équilibre.
Peu de risques du scanner
et peu d'échec diagnostic**



Not so fast....



Etude PROPER

Characteristics	No. (%)		Mean Difference, % (95% CI)	Number Needed to Treat	P Value
	PERC	Control			
Intention-to-treat population, No. ^a	962	954			
Thromboembolic event at 3 mo (primary outcome)	32 (3)	29 (3)	0.2 (−∞ to 1.6) ^b		.12
CTPA performed	129 (13)	220 (23)	9.7 (6.1 to 13.2)	10	<.001
Length of ED stay, median (IQR), h:min	4:36 (3:16 to 6:21)	5:14 (3:50 to 7:18)	−00:36 (−1:08 to −0:04)		<.001
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All-cause death at 3 mo	3 (0.3)	2 (0.2)	0.1 (−0.5 to 0.7)		>.99

Reduction moyenne 36min aux urgences
Moins d'hospit, moins d'introduction d'antico

Etude MODLIGLIANI

Variable	Intervention group (n = 726)		Control group (n = 688)		Difference (95% CI)	
	No.	No. (%) [95% CI]	No.	No. (%) [95% CI]	Adjusted ^a	Unadjusted
Chest imaging ^b	726	221 (30.4) [27.1 to 33.9]	688	275 (40.0) [36.3 to 43.7]	-8.7 (-13.8 to -3.5)	-9.5 (-14.5 to -4.3)
Undue initiation of anticoagulation regimen	718	5 (0.7) [0.2 to 1.6]	686	11 (1.6) [0.8 to 2.9]	-1.4 (-3.1 to 0.4)	-0.9 (-2.2 to 0.2)
Admitted from the ED	725	157 (21.7) [18.7 to 24.8]	688	178 (25.9) [22.6 to 29.3]	-3.0 (-7.7 to 1.6)	-4.2 (-8.7 to 0.3)
All-cause hospital admission at 3 mo	647	85 (13.1) [10.6 to 16.0]	627	99 (15.8) [13.0 to 18.9]	-2.0 (-6.0 to 2.0)	-2.7 (-6.6 to 1.2)
All-cause mortality at 3 mo	689	12 (1.7) [0.9 to 3.0]	660	13 (2.0) [1.1 to 3.3]	0.11 (-1.6 to 1.8)	-0.2 (-1.8 to 1.3)
ED length of stay, median (IQR), h	726	6.0 (4.0 to 8.0)	688	6.0 (5.0 to 9.0)	-1.6 (-2.3 to -0.9)	0.0 (-0.7 to 0.7)

**Reduction moyenne 1h40 aux urgences
Limite moins d'hospit & introduction d'antico**

Risques d'une anticoagulation

5%
hémorragie
par an

1% sévère



Risques d'une hospitalisation

20% au
moins un EI

1% EIG



**Limiter l'usage du TDM en suivant les
règles de décision clinique c'est**

**Moins d'hémorragie
Moins de traitement**

**Moins d'hospit & ses risques
Moins cher**

Moins de temps aux urgences

