



vs.



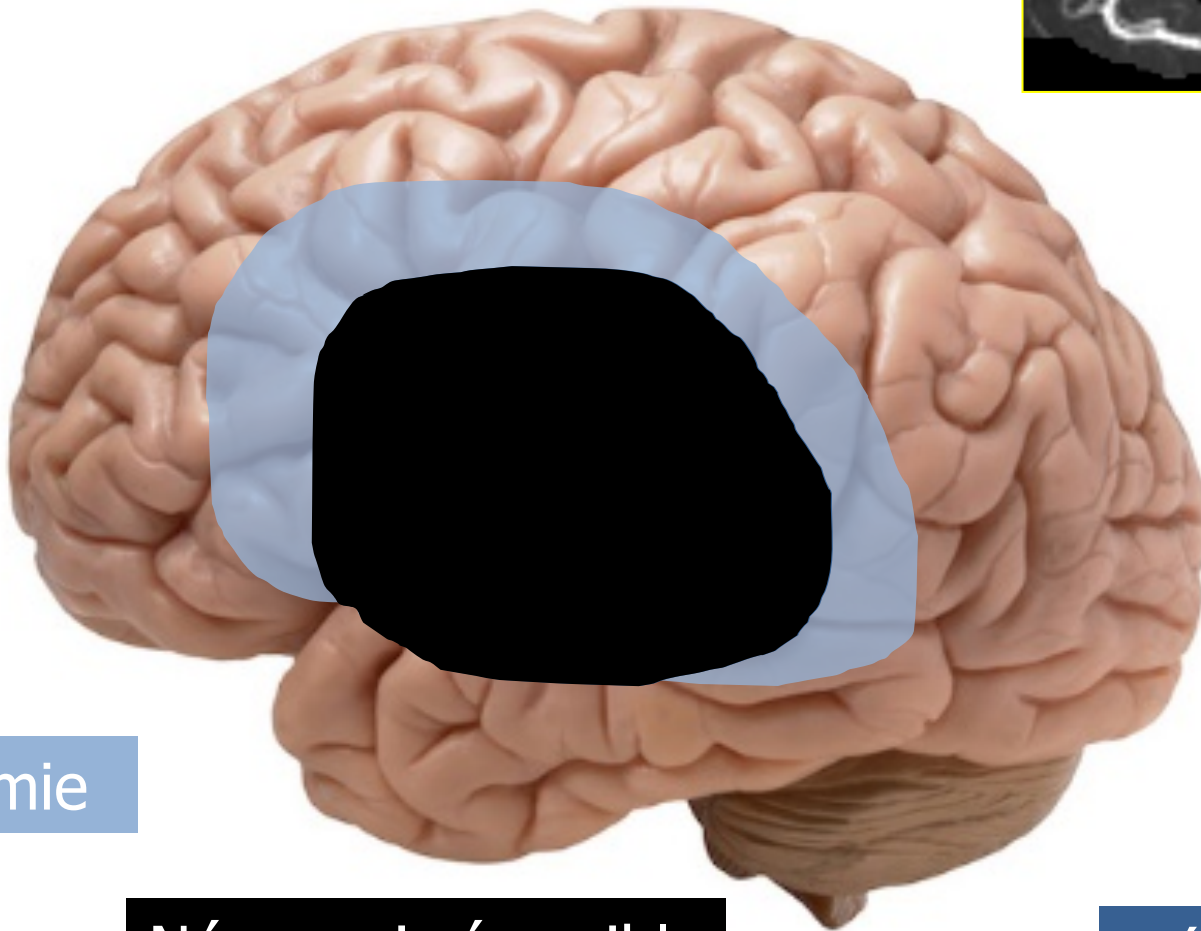
Controverse: quelle imagerie à la phase aiguë ?

Imagerie maximale !

Liens d'intérêt

- Guerbet (formation annuelle journée du CERF)

Traitements de reperfusion: rationnel



Oligémie

Nécrose irréversible
(Ischemic core)

Pénombre

Imagerie à la phase aiguë: approche anglo-saxonne

Imagerie minimale = TDM (+ angioscanner)

Imagerie avancée =

- TDM de perfusion (CTP)
- IRM cérébrale (sans perfusion)
- IRM cérébrale (avec perfusion)
- Imagerie des collatérales

Pourquoi se priver de l'imagerie avancée ?

Principaux arguments

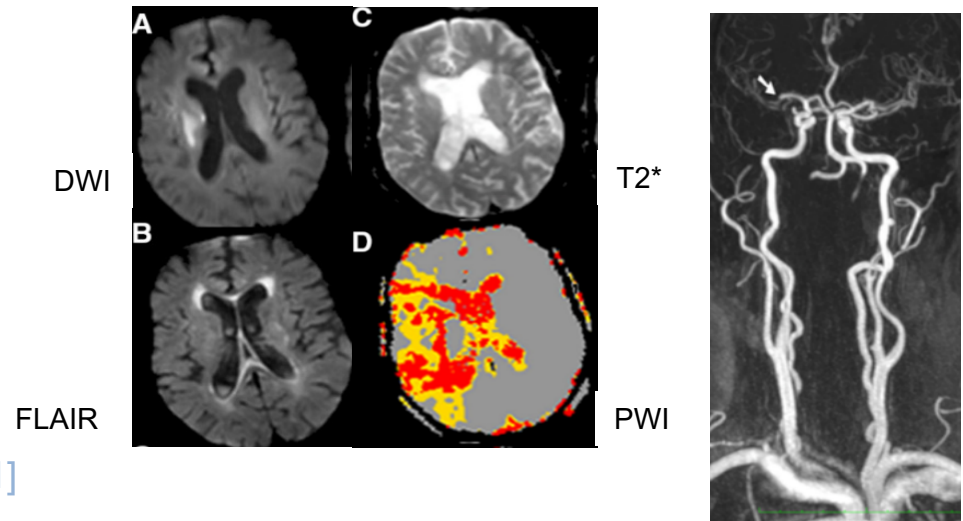
- Chronophage: perte de chance pour le patient
- Analyse/post-traitement complexe
- Patient instable ou agité
- Pacemaker (IRM)
- Disponibilité, coût
- Crainte des complications de l'injection

- ... Inutile

Chronophage ?

IRM: DWI, 3D TOF, FLAIR, T2*: 8 min chez >90% des patients*
Idem + Perfusion + ARM TSA: 11-13 min

* Données C. Oppenheim, Sainte-Anne, 2001-2018



3T EPI-protocoles : 6 min^[1]

1. Nael et al, AJNR et Stroke 2014

Chronophage ?

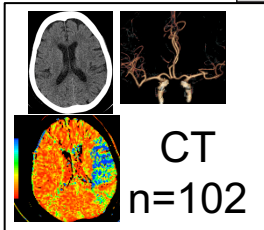
Optimal CT Perfusion Scan Duration for Assessment of Acute Stroke Lesion Volumes

Durée optimale CTP pour obtenir évaluation fiable:
Médiane 33s.
Durée globale CTP < 1min30

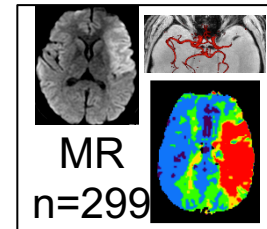
Perte de chance pour le patient ?

7. Multimodal CT and MRI, including perfusion imaging, should not delay administration of IV alteplase.

III: Harm



THRACE: workflow en imagerie (n=401)



Durée Imagerie: médiane

- IRM > scanner : **13** min [10-16] vs **9** min [7-12], $P < 0.001$

Delai Imagerie-thrombolyse (médiane [IQR])

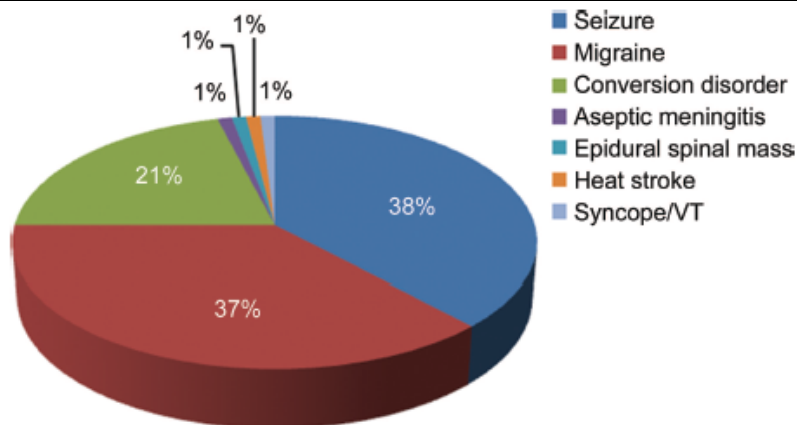
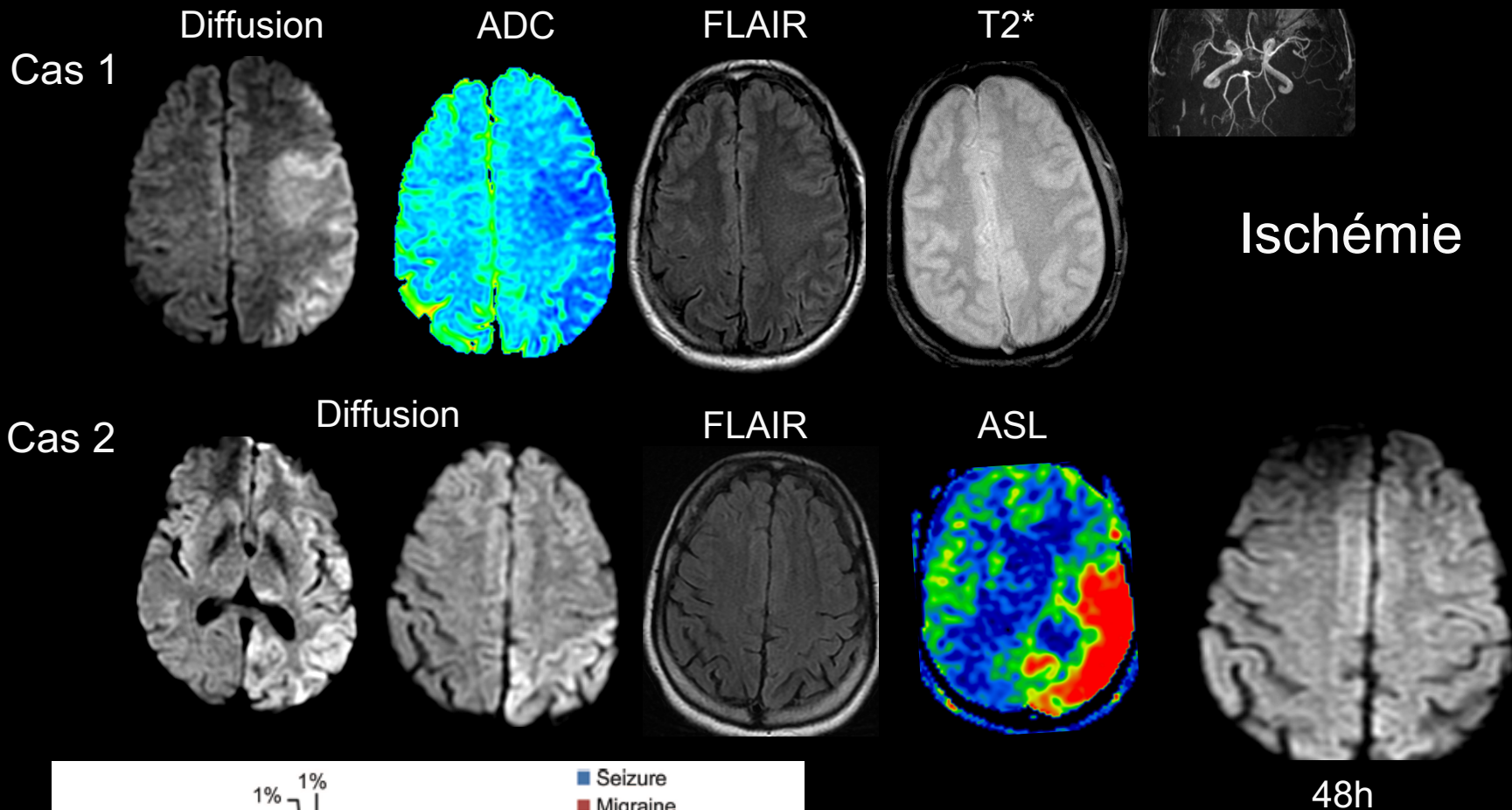
- Symptômes-thrombolyse: IRM: 150 min [124-179] vs CT: 150min [123-180]; $P = 0.38$
- IRM "standard": 30min [22-43] vs IRM multimodale: 33min [25-42], $P = 0.19$
- CT/CTA : 38min [30-60] vs CT/CTA+CTP : 42min [35-54], $P = 0.63$

=> L'imagerie multimodale ne retarde pas l'injection de thrombolytique sur les données de THRACE

AHA/ASA Guidelines, Powers et al, Stroke 2018

Provost et al, Stroke 2019 (accepté)

Perte de chance pour le patient ?



- 512 patients thrombolysés sur scanner sans injection
 - 14% stroke mimics !
- Chernyshev et al, Neurology 2010

Perte de chance pour le patient ?

Table 3 Comparison of outcomes by time epoch

	Spoke hospitals			CT	Hub hospitals		
	2005-2009, n = 86, (%)	2010-2014, n = 125, (%)	p		2005-2009, n = 183, (%)	2010-2014, n = 331, (%)	p
Stroke mimics	8 (9)	25 (20)	0.030		0 (0)	3 (1)	0.175

MRI in
86% of cases

Thrombolyse
de stroke mimics

9% puis 20%

0% puis 1%

Analyse/post-traitement complexe

- En 2013: c'était un problème
 - MR RESCUE: software failure 42% of patients
- En 2019: ce n'est plus un problème dans la plupart des cas
 - Analyse automatisée
 - Seuils bien définis



Kidwell et al, NEJM 2013

Albers et al, NEJM 2018

Patient instable ou agité

Evaluation de la collatéralité artérielle piaie: scanner multiphase

Figure 1

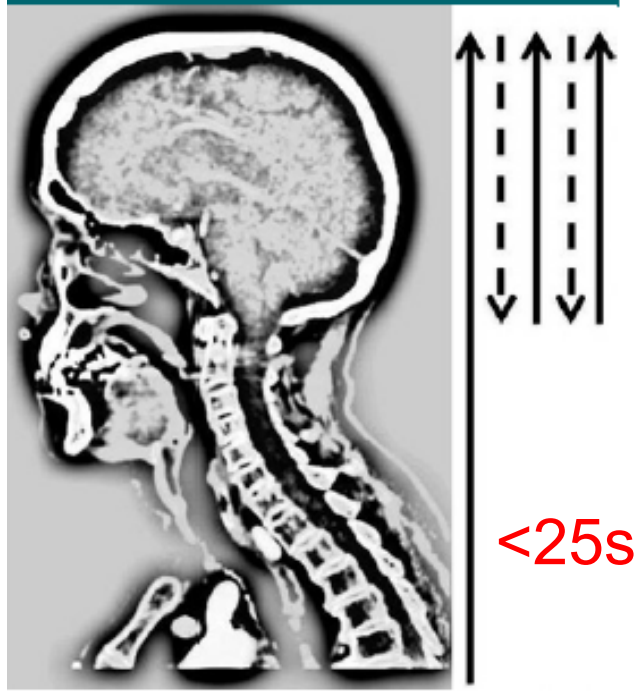
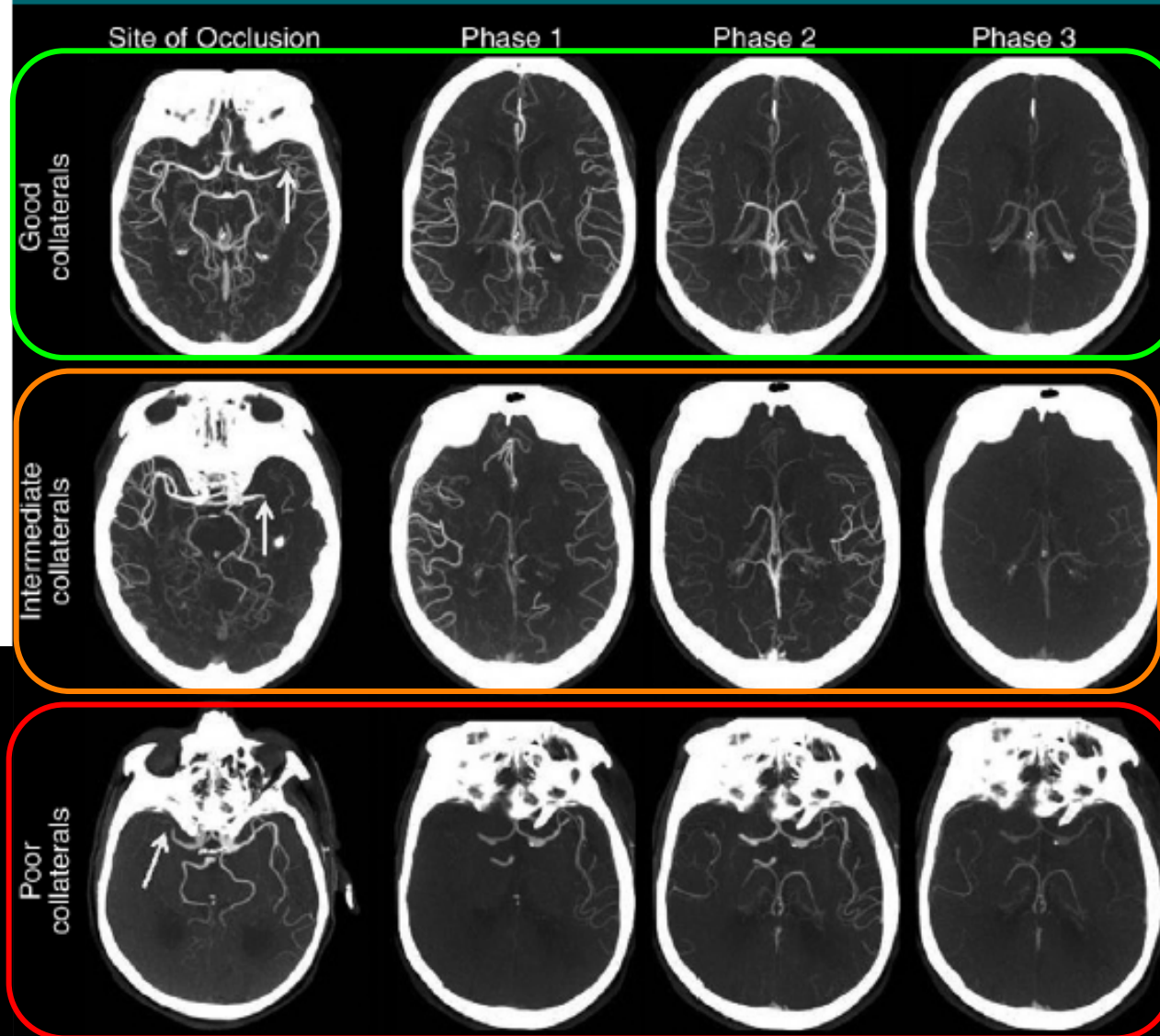


Figure 2



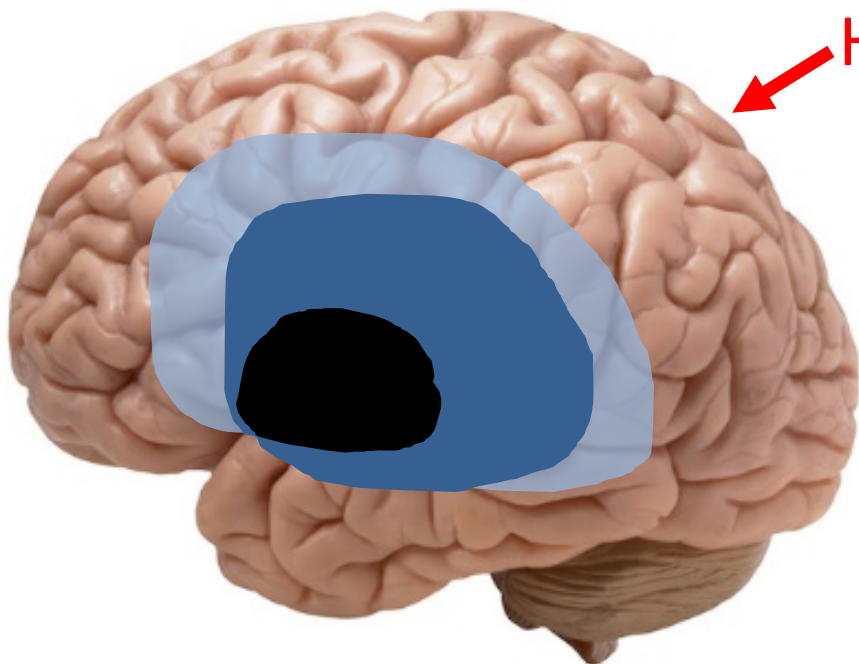
Imagerie avancée: inutile ?

- Pas tous égaux face à l'ischémie...

Oligémie

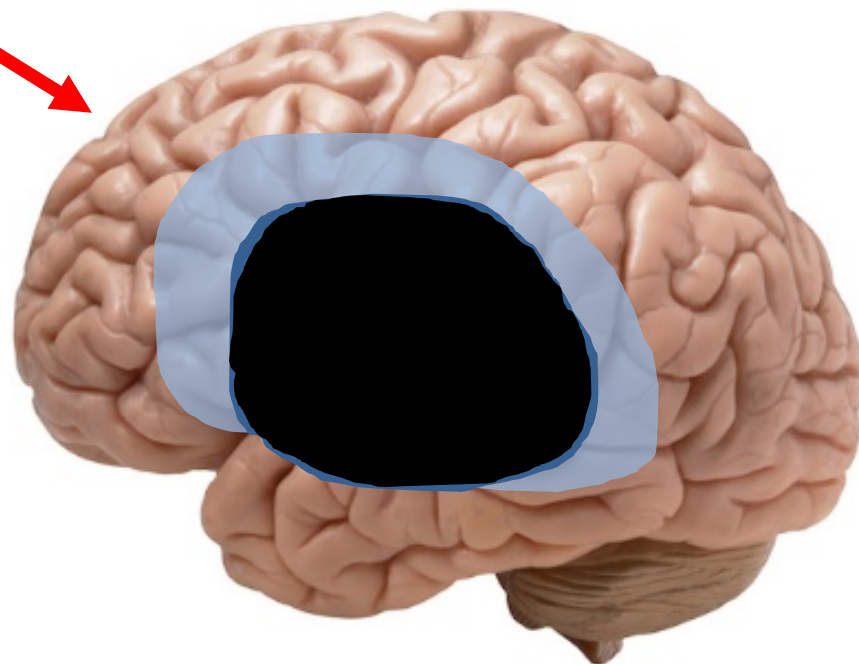
Pénombre

Nécrose



« Bon candidat »

H5



« Mauvais candidat »

Pas tous égaux face à l'ischémie...

- Etude observationnelle PRE-FLAIR
 - 516 patients DWI+, heure symptômes connue et <12h
 - Intérêt du mismatch DWI-FLAIR pour dater l'infarctus

	Sensitivity (95% CI)	Specificity (95% CI)	PPV (95% CI)	NPV (95% CI)
Identification of patients within 4-5 h of symptom onset				
DWI-positive (n=516)	62% (57-67)	78% (72-84)	83% (79-88)	54% (48-60)
MCA (n=469)	63% (57-68)	79% (73-86)	85% (80-90)	53% (47-60)
MCA+NIHSS >3 (n=408)	64% (58-70)	81% (74-87)	87% (81-91)	53% (46-60)
MCA+DWI lesion >5 mL (n=280)	58% (51-66)	84% (75-90)	86% (78-91)	55% (47-63)

Taux de faux négatifs: 38%

Impact of collaterals on the relationship between time and penumbral tissue loss

- 30 patients avec reperfusion dans les 8h

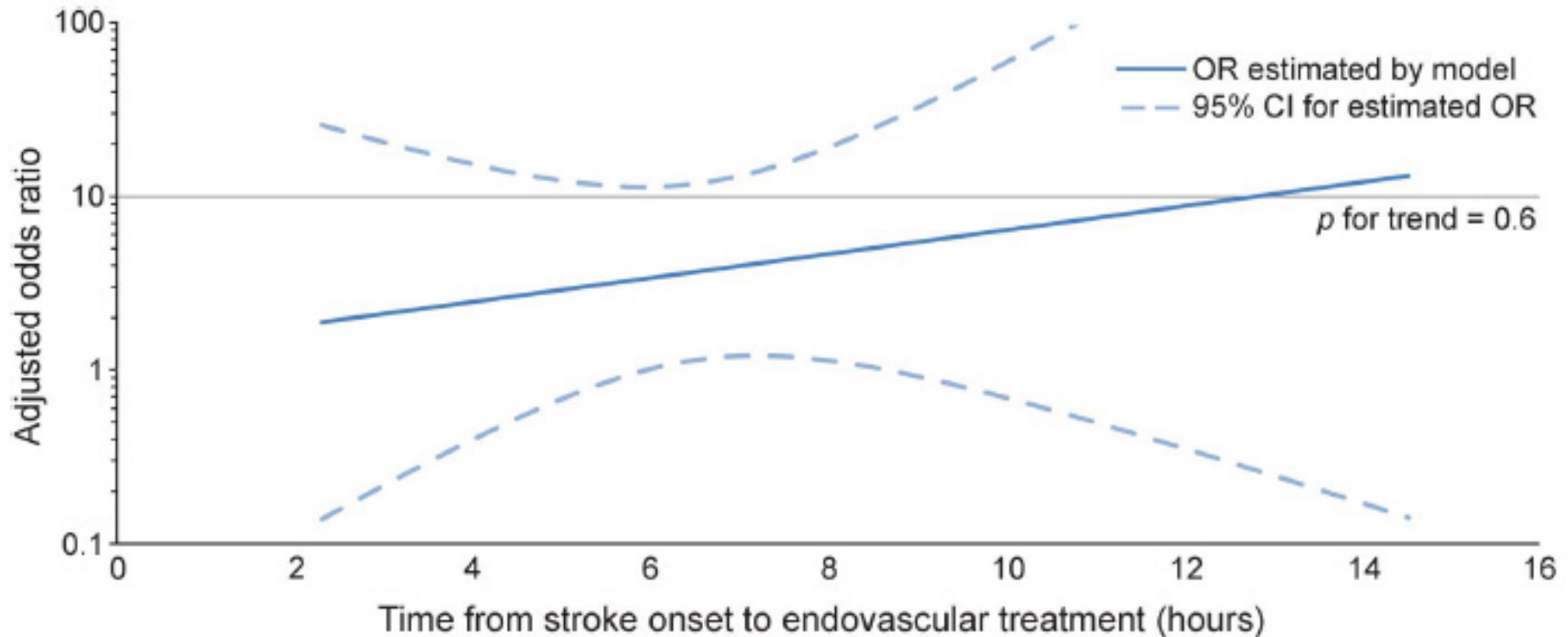
Collateral quality	Penumbral tissue loss per hour	% Penumbral tissue loss despite reperfusion
Grade 0	8.9 ml/h	27%
Grade 1	3.4 ml/h	11%
Grade 2	-1.5 ml/h (DWI reversal)	-2% (DWI reversal)

- In patients with good collaterals, time to reperfusion accounts only for a minor fraction of penumbra loss.

Tissue is more important than time

- Selected patients with target mismatch (n=78), included in DEFUSE 2

Figure 1 Effect of time to treatment on the association between reperfusion and good functional outcome



Tissue is more important than time

- 0-12h (mostly <6h): HERMES Collaboration (N=1287)

mRS ≤ 2
ARD=20%
NNT=5.0

- 6-16h: DEFUSE 3 (N=182)

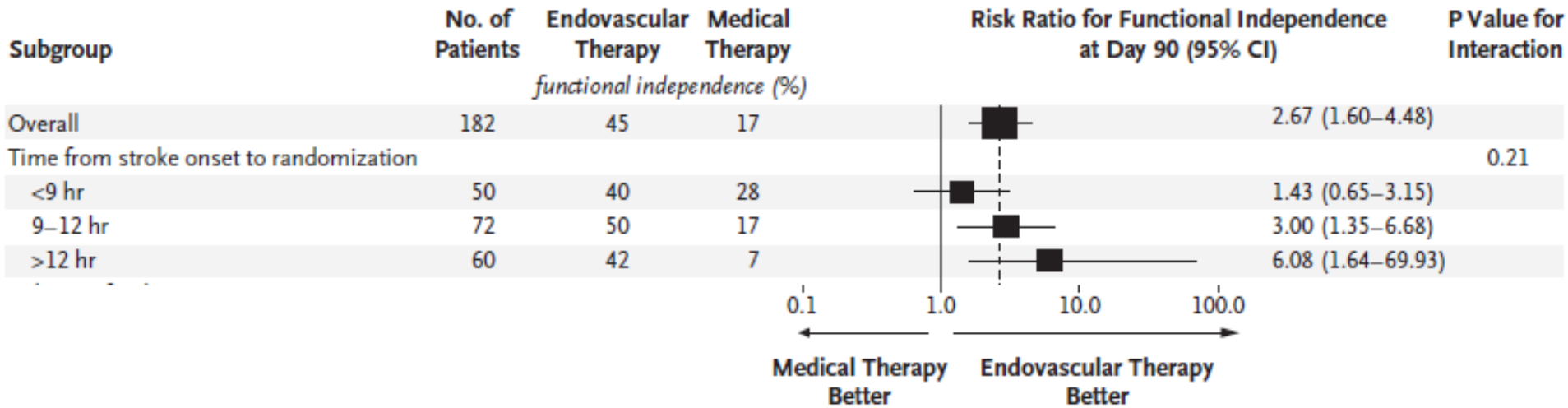
mRS ≤ 2
ARD=28%
NNT=3.6

- 6-24h: DAWN (N=206)

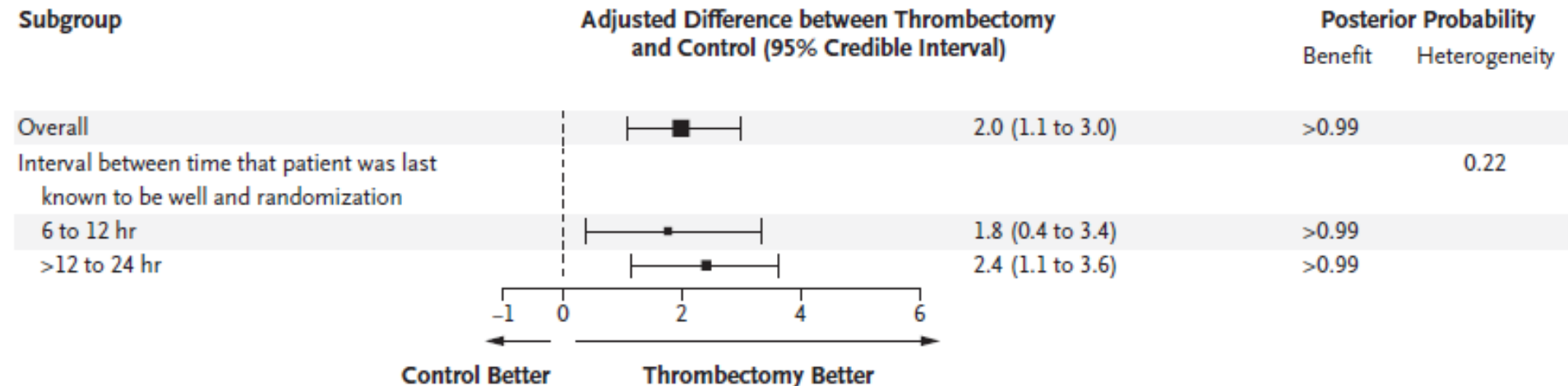
mRS ≤ 2
ARD=36%
NNT=2.8

Tissue is more important than time

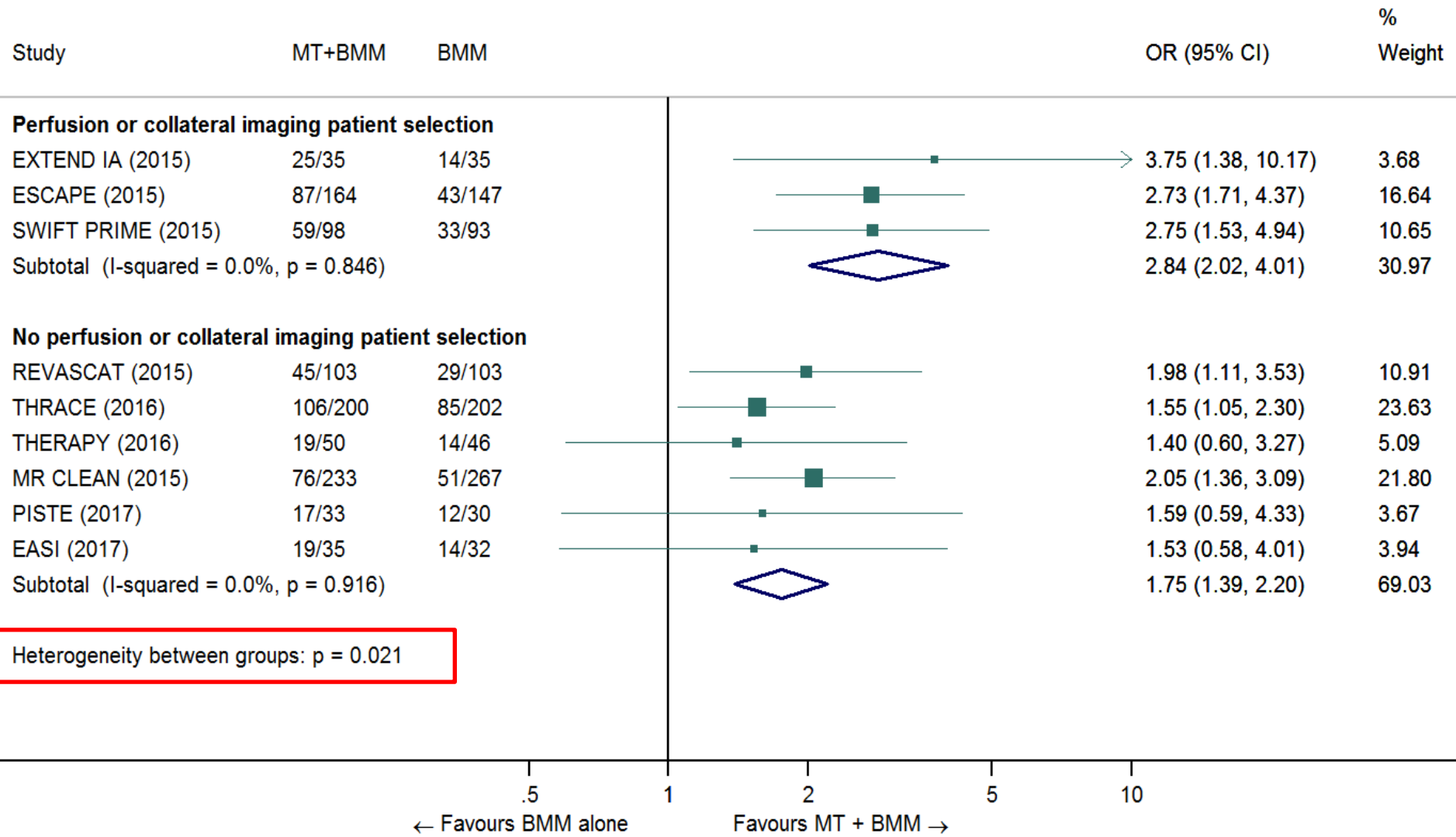
- 6-16h: DEFUSE 3



- 6-24h: DAWN



PICO 9: Benefit of MT according to advanced imaging patient selection: mRS 0-2



Better outcomes with advanced imaging patient selection

Advanced imaging patient selection

EXTEND IA	70	71%	40%
SWIFT PRIME	191	60%	35%
ESCAPE	311	53%	29%
Subtotal (I-squared = 0.0%, p = 0.816)			

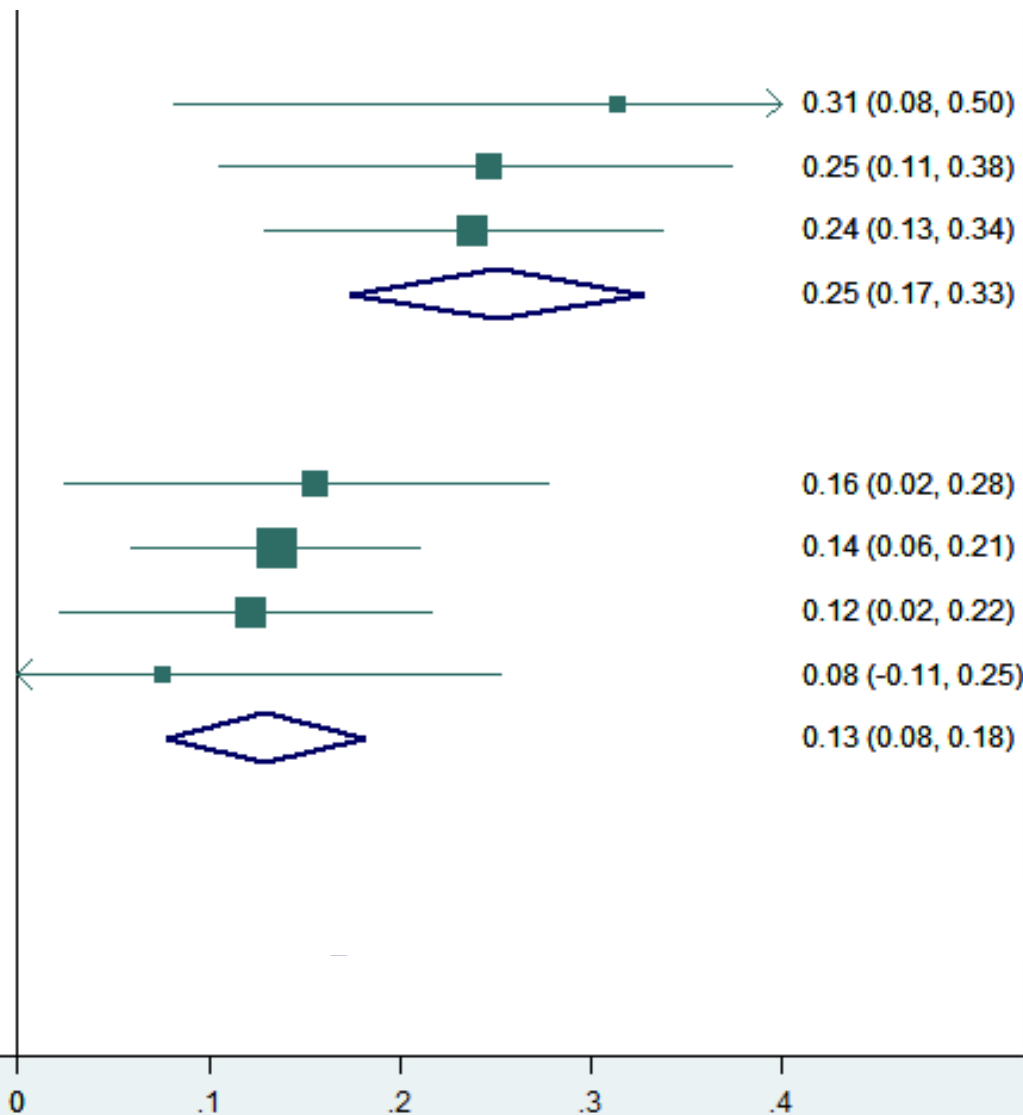
ARD 25%; NNT=4 (3,0-5,9)

No advanced imaging patient selection

REVASCAT	206	44%	28%
MR CLEAN	500	33%	19%
THRACE	385	54%	42%
THERAPY	96	38%	30%
Subtotal (I-squared = 0.0%, p = 0.912)			

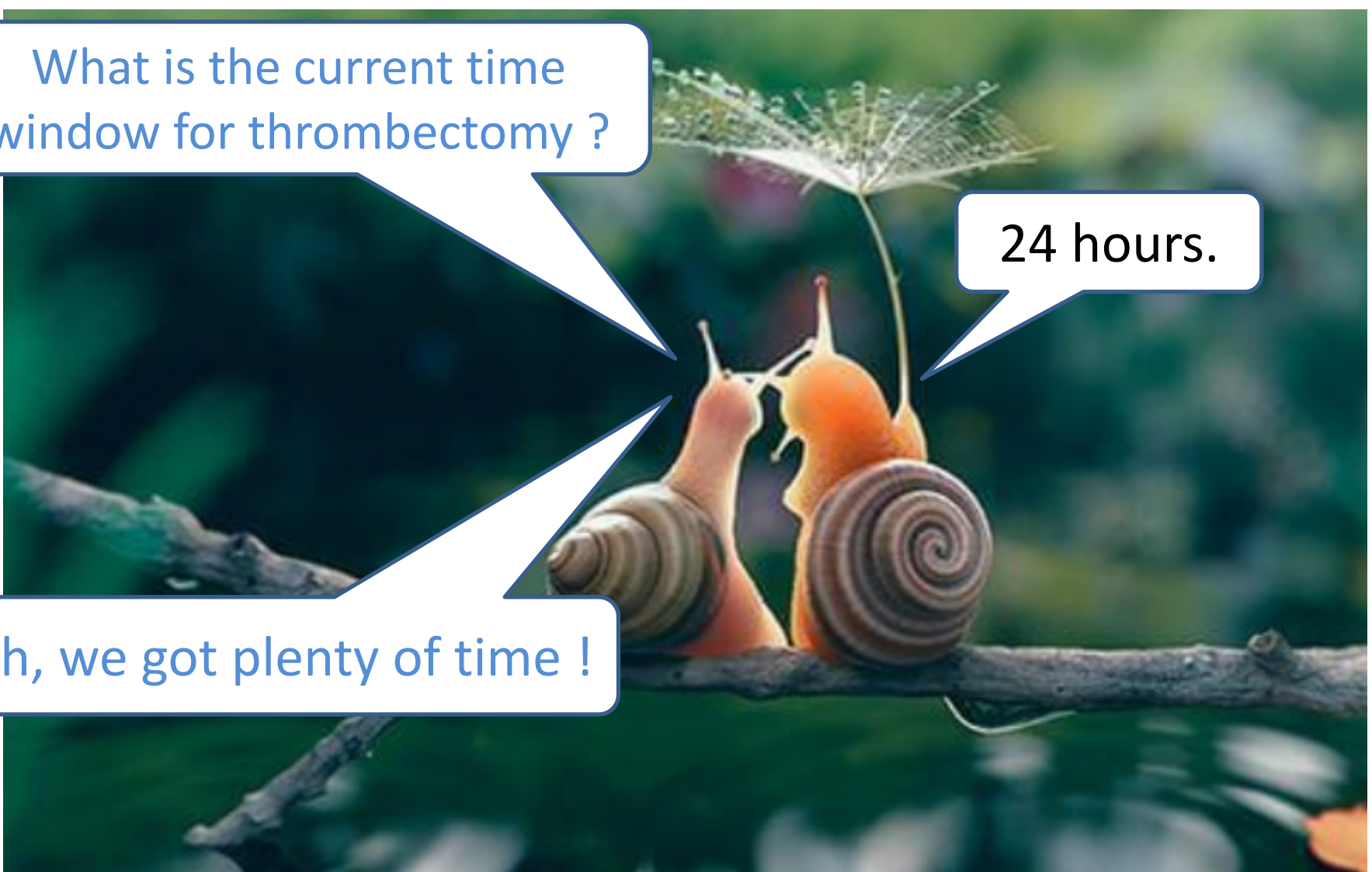
ARD 13%; NNT=7,7 (5,6-12,5)

Heterogeneity between groups: p = 0.011



Conclusions

- Imagerie avancée = visualisation du cœur nécrotique +/- pénombre ou collatérales
- Peu chronophage
- Fenêtres horaires précoces:
 - Thrombolysé moins de stroke mimics
 - Sélectionner les meilleurs candidats à un traitement de reperfusion
- Fenêtres horaires tardives / heure inconnue:
 - Imagerie avancée indispensable (thrombolyse, thrombectomie)
 - Le tissu cérébral est plus important que le temps
- « Time is brain, but collaterals set the pace »
- Chaque patient a une horloge tissulaire propre, l'imagerie avancée permet de la mesurer.

A photograph of two snails on a dark branch. One snail is on the left, facing right, and the other is on the right, facing left. They are positioned near a dandelion seed head. The background is a soft-focus green. Three speech bubbles are overlaid on the image: one at the top left, one at the top right, and one at the bottom left.

What is the current time window for thrombectomy ?

24 hours.

Oh, we got plenty of time !

Merci !

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Evidence-based recommendations

Recommendations

- In adult patients with anterior circulation large vessel occlusion-related acute ischemic stroke presenting from 0-6 hours from time last known well, advanced imaging is not necessary for patient selection.

Quality of evidence: **Moderate** ⊕⊕⊕, Strength of recommendation: **Weak** ↓?

- In adult patients with anterior circulation large vessel occlusion -related acute ischemic stroke presenting beyond 6 hours from time last known well, advanced imaging selection is recommended.

Quality of evidence: **Moderate** ⊕⊕⊕, Strength of recommendation: **Strong** ↑↑