Quoi de neuf en traumato ?

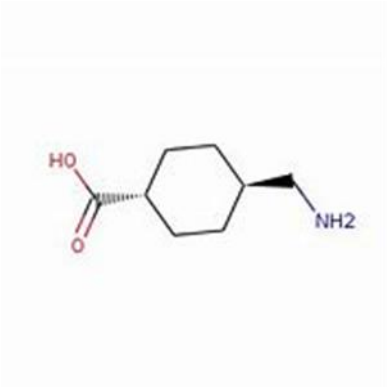
Journée TRENAU – SSE

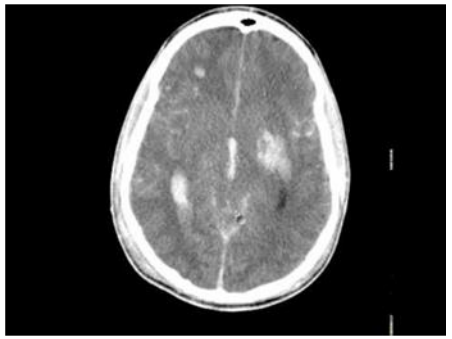
12 octobre 2021

Dr Jules Grèze

Bloc des urgences / déchocage CHUGA

1) Acide tranexamique et traumatisme crânien



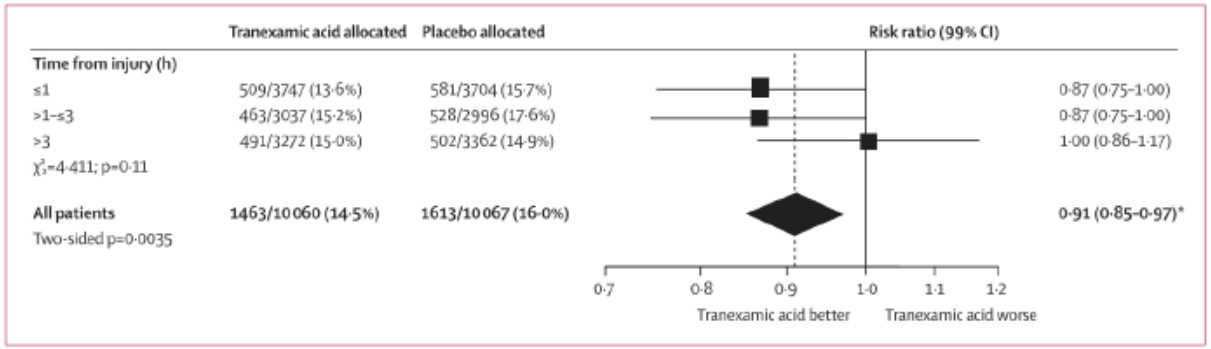


Pourquoi ?

Effects of tranexamic acid on death, vascular occlusive events, and blood transfusion in trauma patients with significant haemorrhage (CRASH-2): a randomised, placebo-controlled trial

Lancet 2010; 376: 23–32
Published Online
June 15, 2010
DOI:10.1016/S0140-6736(10)60835-5

*CRASH-2 trial collaborators**



- rationnel physiopathologique :
    - TC souvent associé à une coagulopathe +/- fibrinolyse
        - est-ce que l'exacyl peut freiner cette coagulopathie ?
        - est-ce que le freinage de cette coagulopathie a un impact sur le devenir ?

Littérature existante

- Exacyl et progression des lésions intracérébral au TDM ?
  - Pas d'impact significatif
    - *CRASH-2 (Clinical Randomisation of an Antifibrinolytic in Significant Haemorrhage) intracranial bleeding study: the effect of tranexamic acid in traumatic brain injury--a nested randomised, placebo-controlled trial* , Perel et al 2012
    - *Tranexamic acid for patients with traumatic brain injury: a randomized, double-blinded, placebo-controlled trial,* Yutthakasemsunt et al, 2013

- Exacyl et hémorragie intracérébrale spontanée ?
  - Pas d'impact sur mRS

Tranexamic acid for hyperacute primary IntraCerebral Haemorrhage (TICH-2): an international randomised, placebo-controlled, phase 3 superiority trial

*Nikola Sprigg, Katie Flaherty, Jason P Appleton, Rustam Al-Shahi Salman, Daniel Bereczki, Maia Beridze, Hanne Christensen, Alfonso Ciccone, Ronan Collins, Anna Czlonkowska, Robert A Dineen, Lelia Duley, Juan Jose Egea-Guerrero, Timothy J England, Kailash Krishnan, Ann Charlotte Laska, Zhe Kang Law, Serefnur Ozturk, Stuart J Pocock, Ian Roberts, Thompson G Robinson, Christine Roffe, David Seiffge, Polly Scutt, Jegan Thanabalan, David Werring, David Whynes, Philip M Bath, for the TICH-2 Investigators**

Lancet 2018; 391: 2107–15

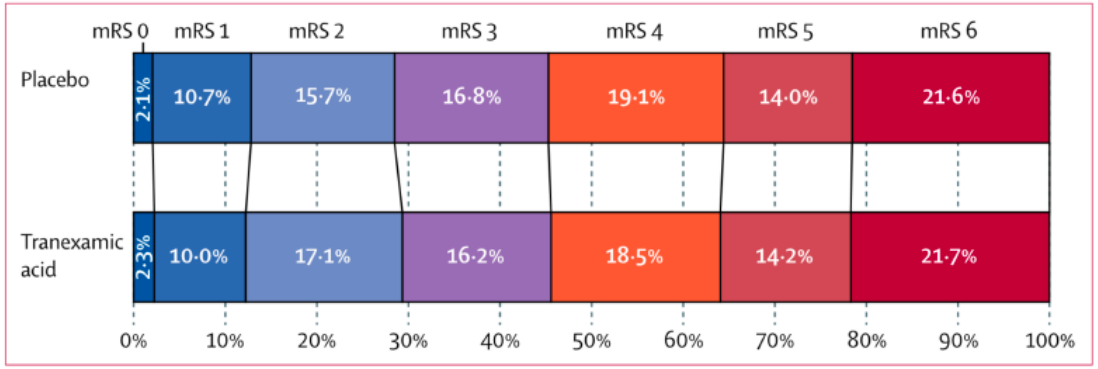


Figure 2: **Shift plot of day 90 mRS**

THE LANCET
Volume 394, Issue 10210, 9–15 November 2019, Pages 1713-1723

Recommended articles

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Citing articles

Articles

Effects of tranexamic acid on death, disability, vascular occlusive events and other morbidities in patients with acute traumatic brain injury (CRASH-3): a randomised, placebo-controlled trial

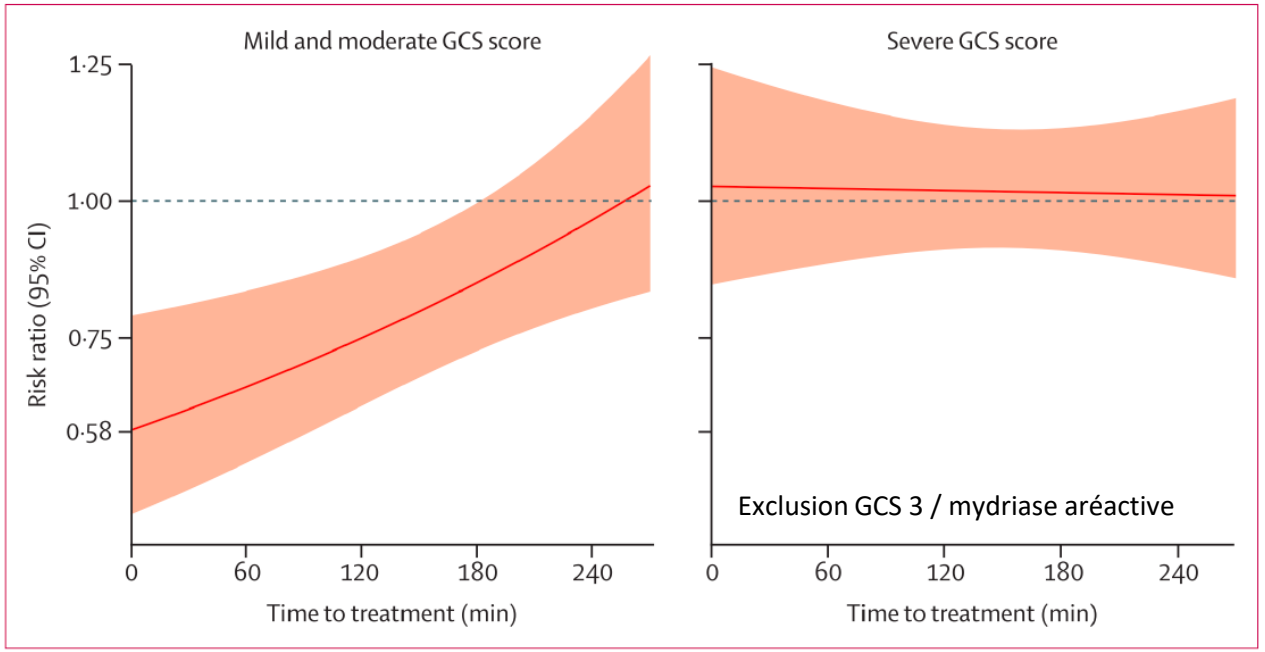
The CRASH-3 trial collaborators †

- Multicentrique, randomisé contre placebo
- **Inclusion :**
  - **≥ 18ans**
  - **TBI ≤ 3h**
  - **GCS ≤ 12 ou sang sur TDM**
  - **absence d'hémorragie extra-crânienne grave (pas d'indication extra-crânienne de TXA)**
- **Intervention → TXA 1g sur 10min puis 1g sur 8h, dans les 3h après TBI**
- Critère de jugement principal : taux de décès **d'origine neurologique**, dans les 28j suivant la randomisation

	Tranexamic acid	Placebo	Risk ratio (95% CI)
All	855/4613 (18·5%)	892/4514 (19·8%)	0·94 (0·86–1·02)
Excluding patients with GCS score of 3 or bilateral unreactive pupils*	485/3880 (12·5%)	525/3757 (14·0%)	0·89 (0·80–1·00)

GCS=Glasgow Coma Scale. *Prespecified sensitivity analysis.

Table 2: **Effect of tranexamic acid on head injury-related death in patients randomly assigned within 3 h of injury**



- Pas de différence sur effets secondaires

- **Bénéfice potentiel dans le sous groupe TC léger** et intermédiaire si administré dans les 3h
- Balance bénéfice/risque/cout favorable

Original Investigation FREE

September 8, 2020

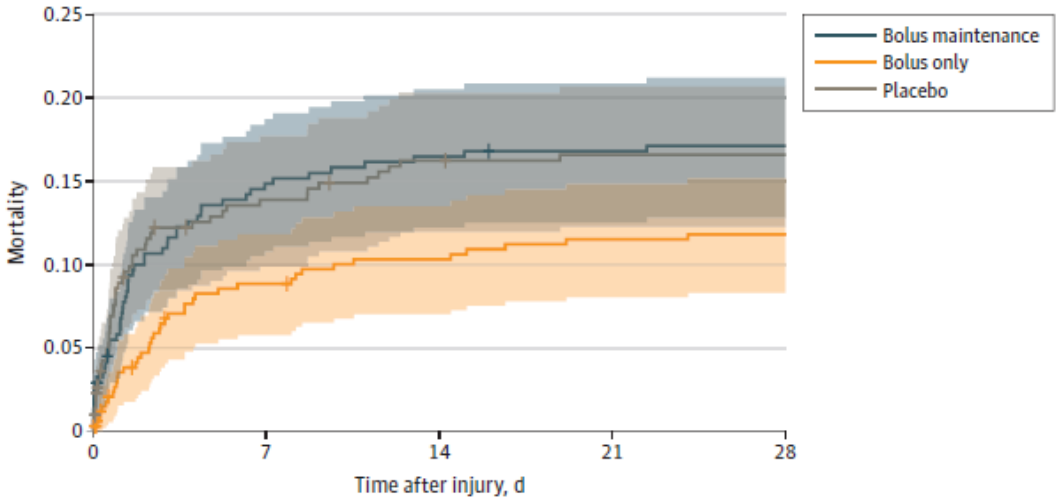
Effect of Out-of-Hospital Tranexamic Acid vs Placebo on 6-Month Functional Neurologic Outcomes in Patients With Moderate or Severe Traumatic Brain Injury

Susan E. Rowell, MD, MBA[1,2]; Eric N. Meier, MS[3]; Barbara McKnight, PhD[3]; et al

» Author Affiliations | Article Information

JAMA. 2020;324(10):961-974. doi:10.1001/jama.2020.8958

- RCT double aveugle multicentrique
- 1063 TC randomisés < 2h
- GCS < 12
- Administration exacyl dans les 2h



Outcome	Treatment group, No. (%)[a]		Adjusted difference (95% CI)[b,c]	
	Combined tranexamic acid group (n = 657)	Placebo (n = 309)	Combined tranexamic acid group vs placebo	*P* value
Primary outcome				
6-mo Glasgow Outcome Scale-Extended score >4[d]	425 (65)	192 (62)	3.5% (−0.9% to 10.2%)[c]	.16 (benefit); .84 (harm)
Secondary outcomes (exploratory)				
28-d mortality[d]	94 (14)	53 (17)	−2.9% (−7.9% to 2.1%)	.26
6-mo Disability Rating Scale score, median (IQR)[d]	1 (0 to 5)	1 (0 to 8)	−0.9 (−2.5 to 0.7)	.29
Progression of intracranial hemorrhage[e,f]	53 (16) (n = 332)	30 (20) (n = 148)	−5.4% (−12.8% to 2.1%)	.16

Pas d'impact de l'exacyl préhospitalier sur la mortalité et le devenir fonctionnel chez les TC graves et modérés

Original Investigation

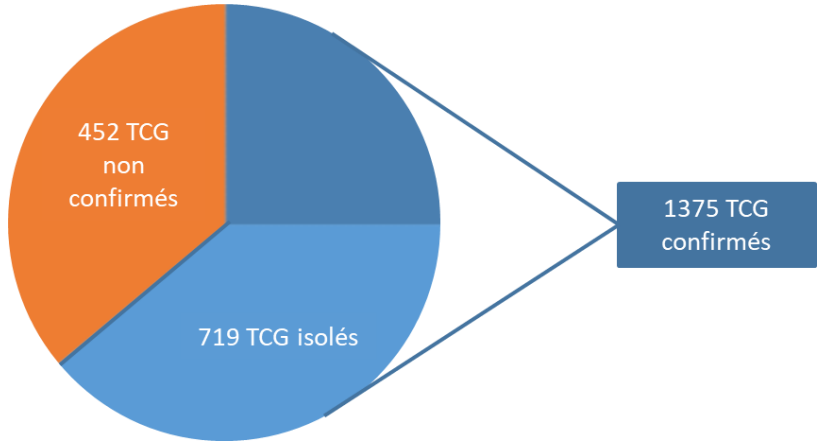
December 7, 2020

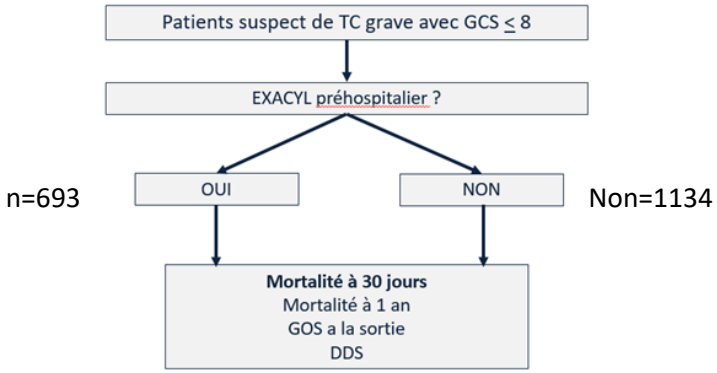
Association Between Prehospital Tranexamic Acid Administration and Outcomes of Severe Traumatic Brain Injury

Sebastiaan M. Bossers, MD[1]; Stephan A. Loer, PhD[1]; Frank W. Bloemers, PhD[2]; et al

Author Affiliations

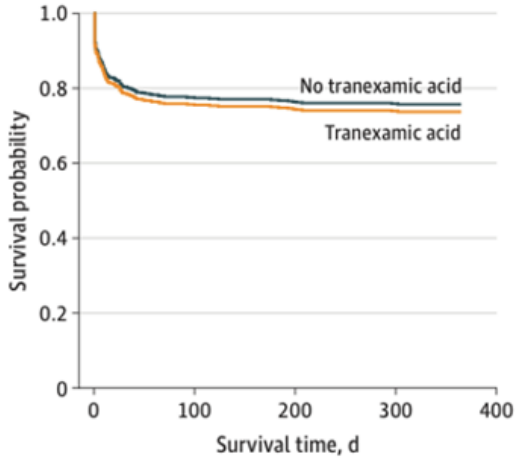
Cohorte prospective observationnelle
- GCS median = 4



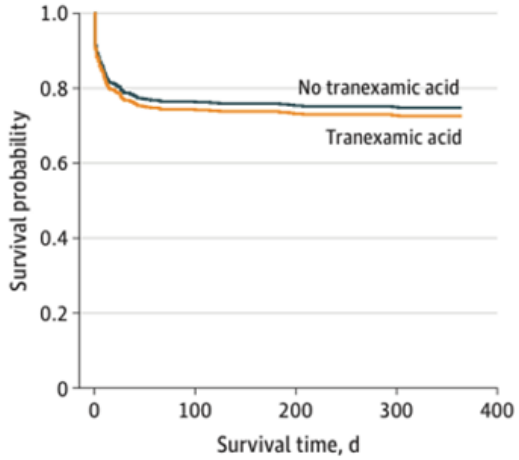


n=693

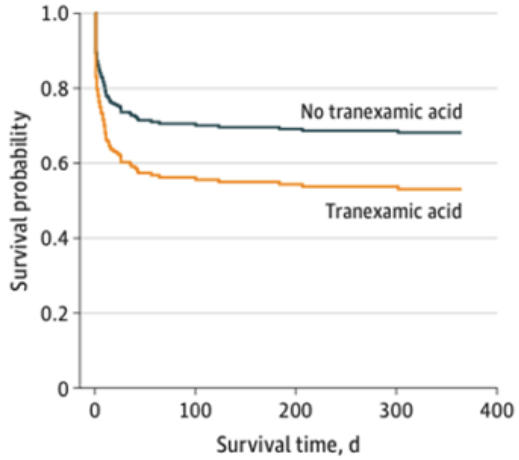
Non=1134



Cohorte complète



TCG confirmés



TCG isolés

Association entre EXACYL et ↗ mortalité à M12 avec **OR 3,31** (1,20 à 9,16) après ajustement dans le **groupe TCG isolé**

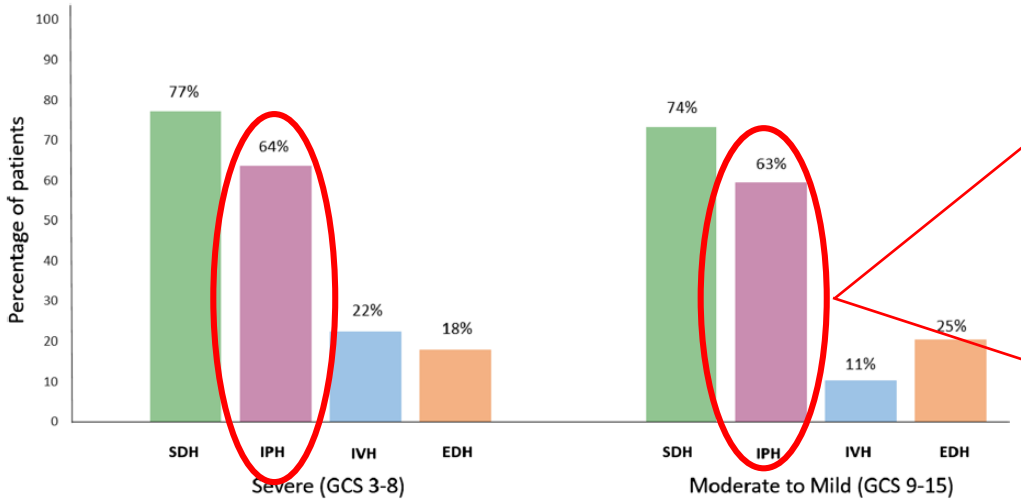
European Journal of Trauma and Emergency Surgery (2021) 47:261–268
https://doi.org/10.1007/s00068-020-01316-1

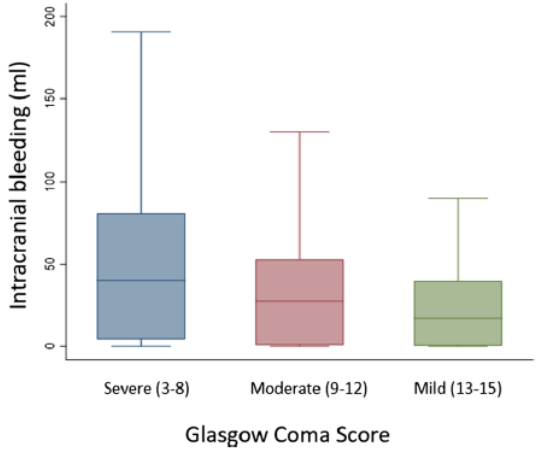
ORIGINAL ARTICLE

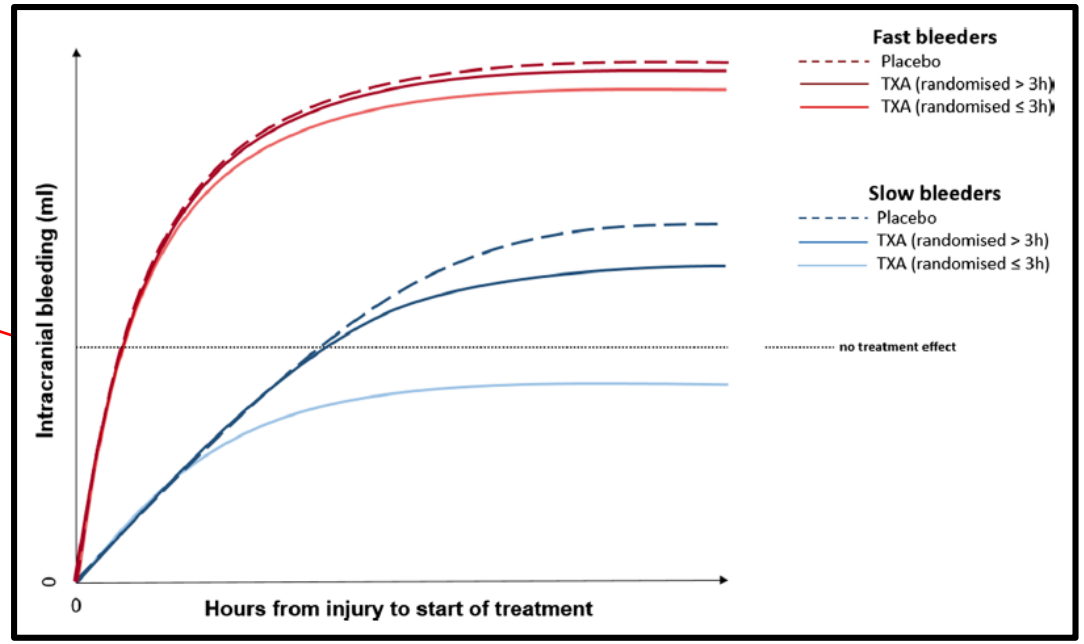
Tranexamic acid in traumatic brain injury: an explanatory study nested within the CRASH-3 trial

The CRASH-3 Intracranial Bleeding Mechanistic Study Collaborators[1]

Received: 14 October 2019 / Accepted: 28 January 2020 / Published online: 19 February 2020







- Exacyl efficace uniquement sur l'hémorragie

- **Pas d'intéret sur lésion directe**
- **Bénéfice potentiel sur lésions secondaires**
- **Administration précoce ++**

Polytraumatisé

Exacyl selon protocole Crash 2

Suspicion TC Isolé

GCS 13-8

Exacyl précoce

Mais…

- Impact faible
- Prioriser les actions +

GCS <8
Areactivité pupillaire

Non recommandé

Attente TDM ??

Hyperprécoce ??

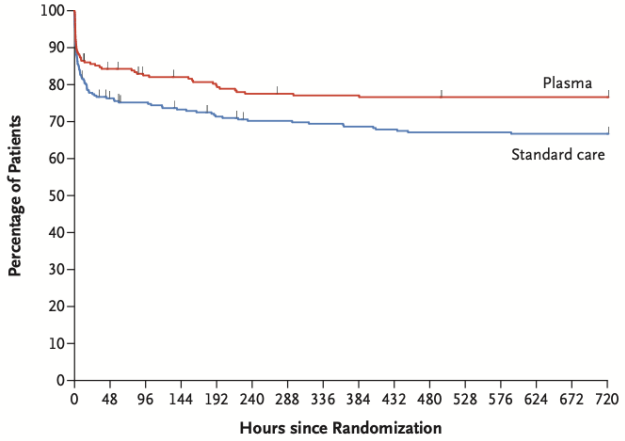
2) Plyo préhospitaliers et traumatismes crâniens

Original Investigation ONLINE ONLY FREE

December 18, 2019

Association of Prehospital Plasma Transfusion With Survival in Trauma Patients With Hemorrhagic Shock When Transport Times Are Longer Than 20 Minutes

A Post Hoc Analysis of the PAMPer and COMBAT Clinical Trials



PAMPER et COMBAT
- Bénéfice pour transports >20min
- Étude en sous groupe suggère un bénéfice pour les TC

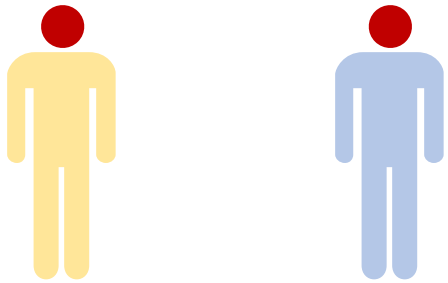
Recommandations pour la Pratique Professionnelle

SFAR

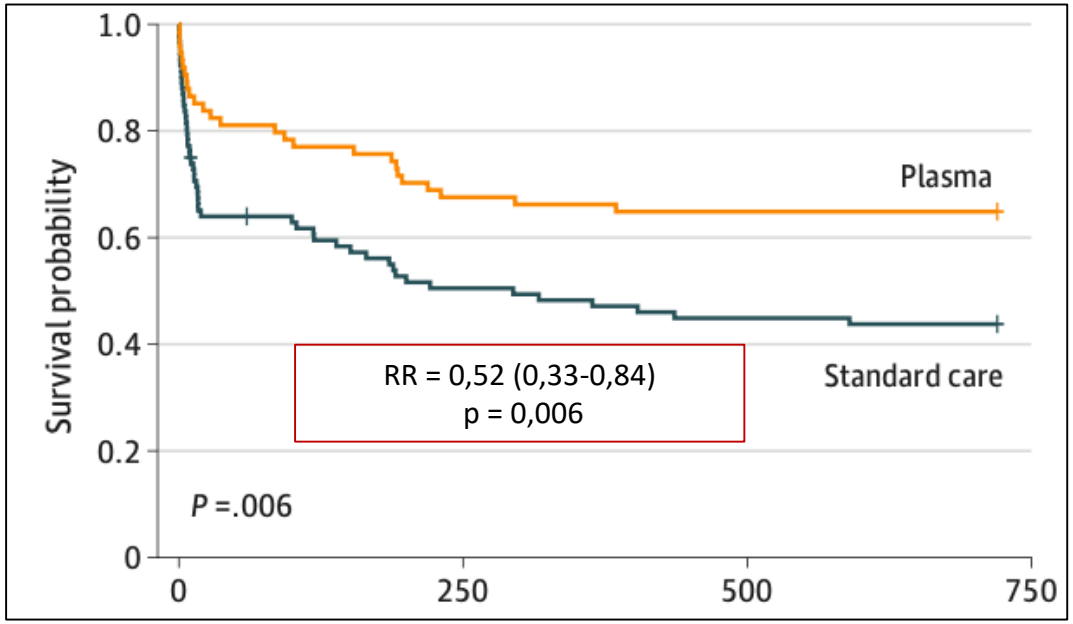
Indications de transfusion de plasmas lyophilises (PLYO)
Chez un patient en choc hémorragique
Ou a risque de transfusion massive en milieu civil
(adulte, enfant et nouveau-né)

- Population générale : traumatisés PAS < 70 ou <90 et FC > 108
- Analyse en sous-groupe AIS crâne >2

166 traumatisés crâniens



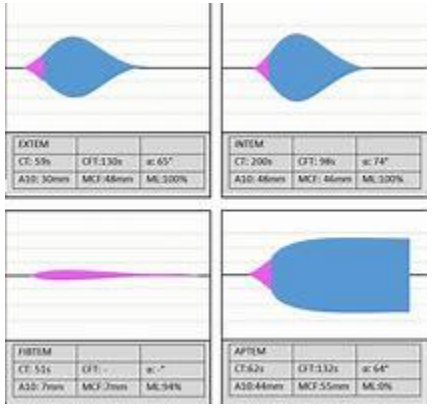
	PFC (n = 74)	Standard (n = 92)	p
Mortalité a J30	26 (**35,1%**)	51 (**55,4%**)	0,01
Mortalité H24	12 (16,2%)	33 (35,9%)	0,08



Donc

- Place des plyo dans les EFS à rediscuter au sein de chaque centre
- A prendre avec valise O en cas de suspicion et transport long ?

3) Tests viscoélastiques et choc hémorragique

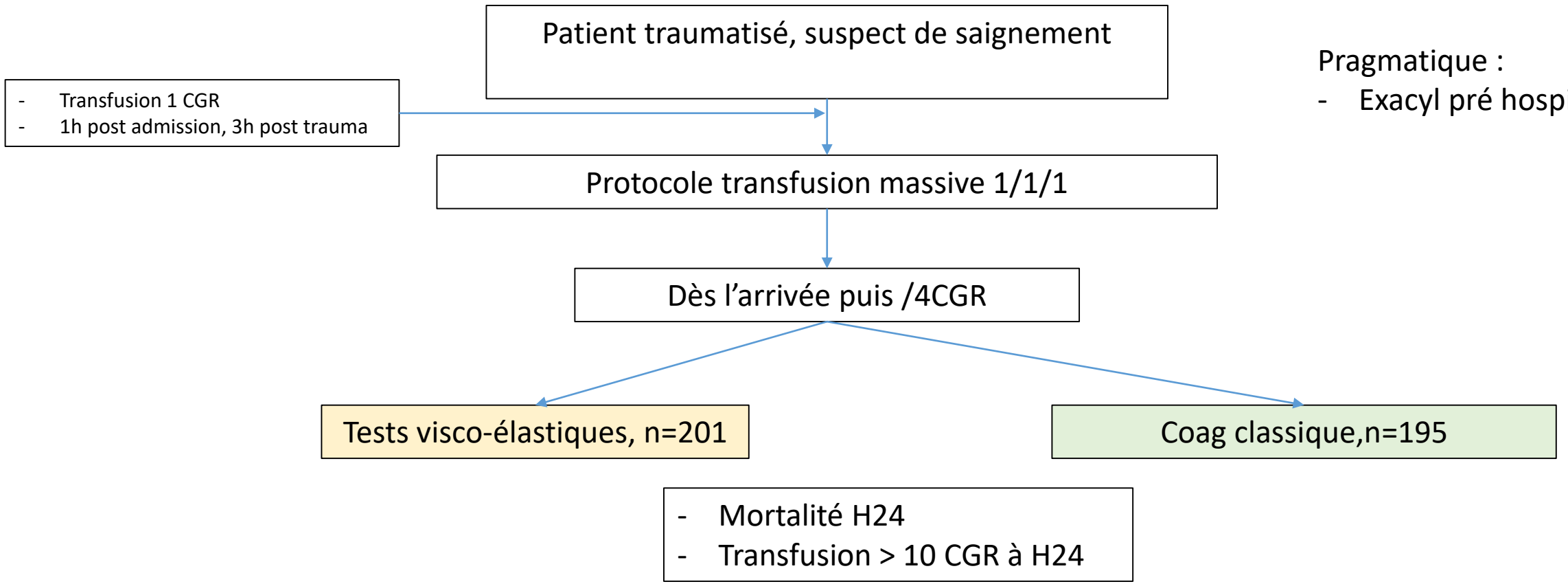


ORIGINAL

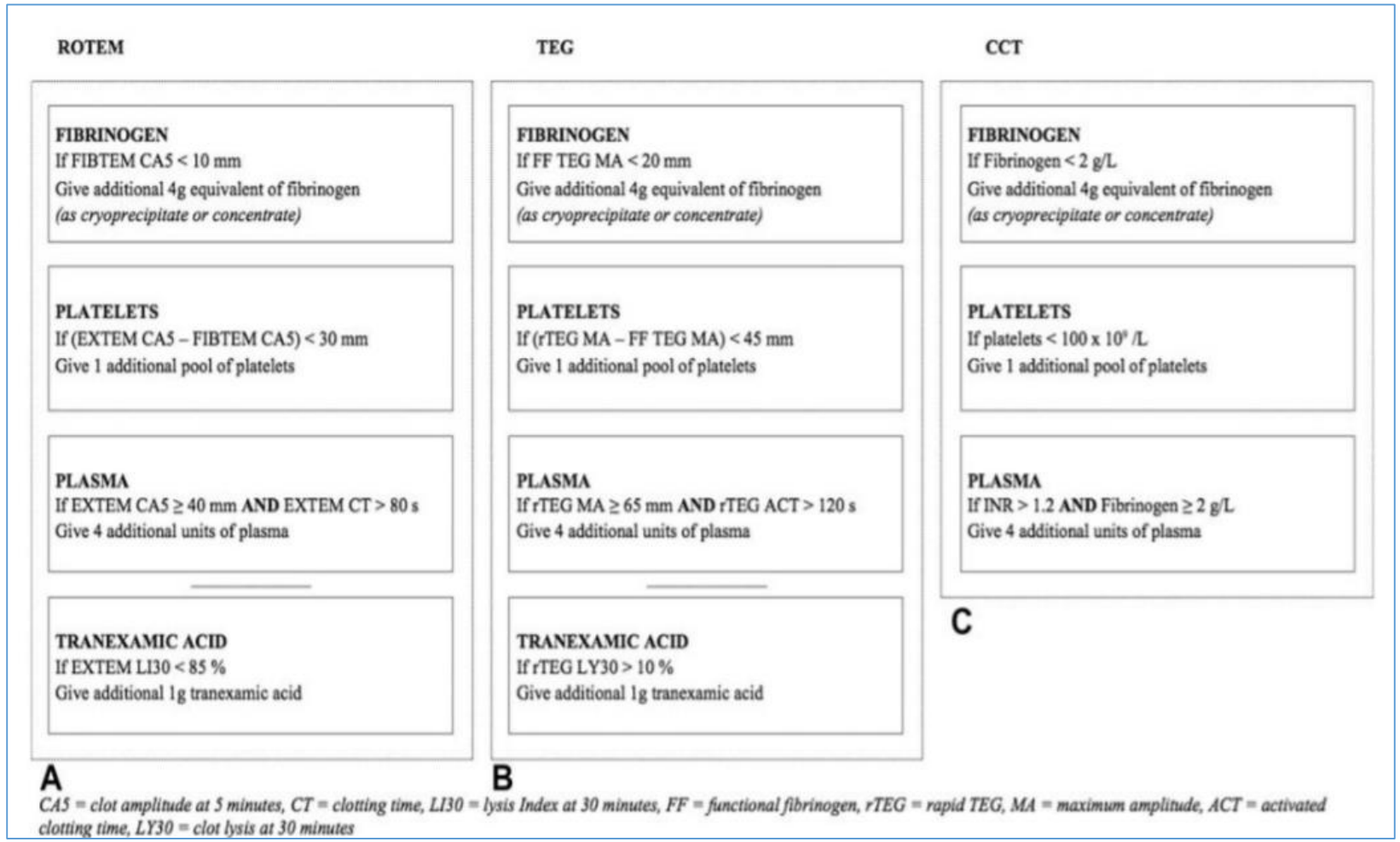
Viscoelastic haemostatic assay augmented protocols for major trauma haemorrhage (ITACTIC): a randomized, controlled trial

K. Baksaas-Aasen[1], L. S. Gall[2], J. Stensballe[3], N. P. Juffermans[4], N. Curry[5], M. Maegele[6], A. Brooks[7], C. Rourke[2], S. Gillespie[2], J. Murphy[8], R. Maroni[8], P. Vulliamy[2], H. H. Henriksen[3], K. Holst Pedersen[3], K. M. Kolstadbraaten[1], M. R. Wirtz[4], D. J. B. Kleinveld[4], N. Schäfer[6], S. Chinna[7], R. A. Davenport[2], P. A. Naess[1], J. C. Goslings[4], S. Eaglestone[2], S. Stanworth[5,9], P. I. Johansson[3], C. Gaarder[1] and K. Brohi[2*]

TP/TCA vs ROTEM/TEG dans protocoles de transfusion massive ?



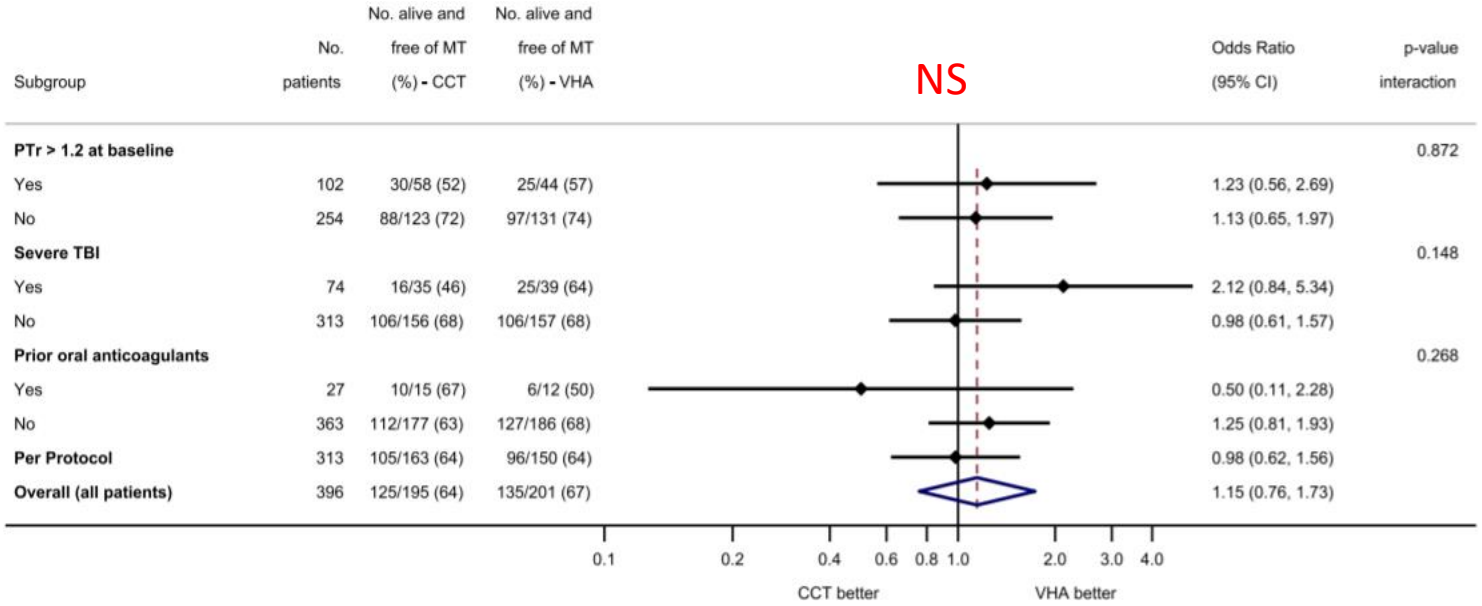
Pragmatique :
- Exacyl pré hospitalier



CA5 = clot amplitude at 5 minutes, CT = clotting time, LI30 = lysis Index at 30 minutes, FF = functional fibrinogen, rTEG = rapid TEG, MA = maximum amplitude, ACT = activated clotting time, LY30 = clot lysis at 30 minutes

Seulement 1/3 coagulopathes à l'arrivée et 10% au premier TEG!

Tendance bénéfique chez les TC



Cause of Death	Patients	Patients
Uncontrolled Bleeding	17 (30%)	13 (25%)
# Head Injury	19 (34%)	16 (30%)
Multiple Organ Dysfunction	6 (11%)	10 (19%)
Thromboembolism	0 (0%)	2 (4%)
Multiple Injuries	4 (7%)	1 (2%)
Other	10 (18%)	9 (17%)
Unknown	0 (0%)	2 (4%)
Total	56 (100%)	53 (100%)

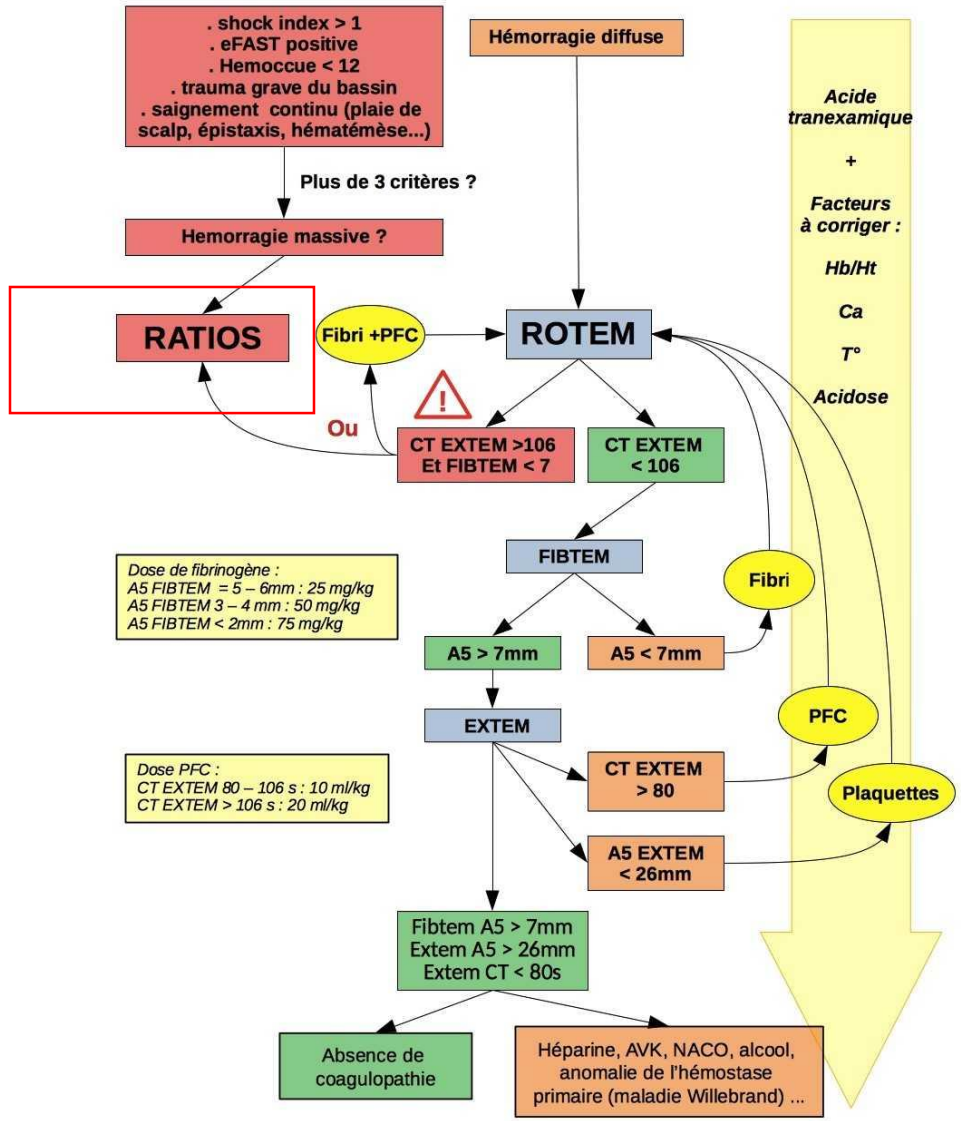
Table S1 Interventions & 24-hour transfusion requirements

Subgroup	% receiving study intervention^	Time to 1st study intervention (mins)	RBCs (units)	FFP/Octaplasma (units)	Fibrinogen equivalent (g)	Platelets (pools)
Baseline to Haemostasis						
All – Intention-to-treat (n with haemostasis = 348)						
CCT	62/170 (36%)	80 (60-106)	3 (1-6)	4 (2-6)	0 (0-4)	1 (0-1)
# VHA	120/178 (67%)**	61 (48-85)*	3 (1-6)	4 (1-6)	# 4 (0-4)*	1 (0-2)**
Severe TBI (n with haemostasis = 63)						
CCT	6/26 (23%)	61 (34-101)	2 (0-3)	3 (1-6)	0 (0-0)	0 (0-1)
VHA	26/37 (70%)**	53 (45-85)	3 (1-6)*	3 (1-6)	4 (0-4)*	2 (0-2)*

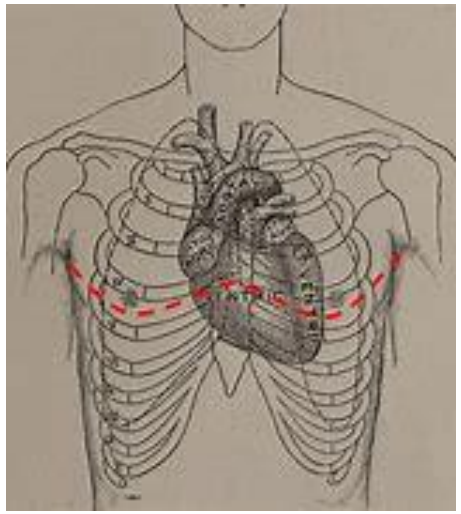
Donc

- Les tests viscoélastiques n'améliorent pas le pronostic des patients recevant un protocole de transfusion massive dans cette étude
- mais induisent 2 fois plus d'actions hémostatiques que les tests classiques
- Avec une tendance semblant bénéfique dans le sous groupe de TCG

- Sous groupes des TC ? Hémorragies diffuses (membres/face…)…
- Critère mortalité à 24h et monitorage de la coagulation discutable


. shock index > 1
. eFAST positive
. Hemoccue < 12
. trauma grave du bassin
. saignement continu (plaie de scalp, épistaxis, hématémèse...)
Plus de 3 critères ?
Hemorragie massive ?
Hémorragie diffuse
RATIOS
Fibri +PFC
ROTEM
Ou
CT EXTEM >106 Et FIBTEM < 7
CT EXTEM < 106
FIBTEM
Dose de fibrinogène :
A5 FIBTEM = 5 – 6mm : 25 mg/kg
A5 FIBTEM 3 – 4 mm : 50 mg/kg
A5 FIBTEM < 2mm : 75 mg/kg
Fibri
A5 > 7mm
A5 < 7mm
EXTEM
PFC
Dose PFC :
CT EXTEM 80 – 106 s : 10 ml/kg
CT EXTEM > 106 s : 20 ml/kg
CT EXTEM > 80
Plaquettes
A5 EXTEM < 26mm
Fibtem A5 > 7mm
Extem A5 > 26mm
Extem CT < 80s
Absence de coagulopathie
Héparine, AVK, NACO, alcool, anomalie de l'hémostase primaire (maladie Willebrand) ...
Acide tranexamique
+
Facteurs à corriger :
Hb/Ht
Ca
T°
Acidose

4) Thoracotomie de ressuscitation



Emergency Resuscitative Thoracotomy: A Nationwide Analysis of Outcomes and Predictors of Futility

Presented at the 15th Annual Academic Surgical Congress, Orlando, Florida, February 4-6, 2020, as an oral presentation.

Vahe S. Panossian BS, Charlie J. Nederpelt BS, Majed W. El Hechi MD, David C. Chang MBA, MD, MPH, PhD, April E. Mendoza MD, Noelle N. Saillant MD, George C. Velmahos MD, PhD, Haytham M.A. Kaafarani MD, MPH

1,400,000 patients screenés
2000 inclus !
400 survivants (19,6 %)

- 1) thoracotomie
- 2) pericardotomie
- 3) massage cardiaque

- Attention ≠ thoracostomie +

Table 4 – Backward stepwise multivariable logistic regression analysis with death as the dependent variable (*N* = 1146).

Death	OR	*P*	95% CI
Blunt injury	4.03	<0.001	2.72-5.98
No SOL	3.64	0.037	1.08-12.24
Age 60 y and older	2.71	0.011	1.26-5.82
EMS pulse <60 bpm	3.43	<0.001	1.73-6.79
ED pulse <60 bpm	4.70	<0.001	2.47-8.94
ISS ≥16	1.52	0.091	0.93-2.49

The model removed female (*P* = 0.583) and ED SBP <90 mm Hg (*P* = 0.757) because they were found to be nonsignificant.

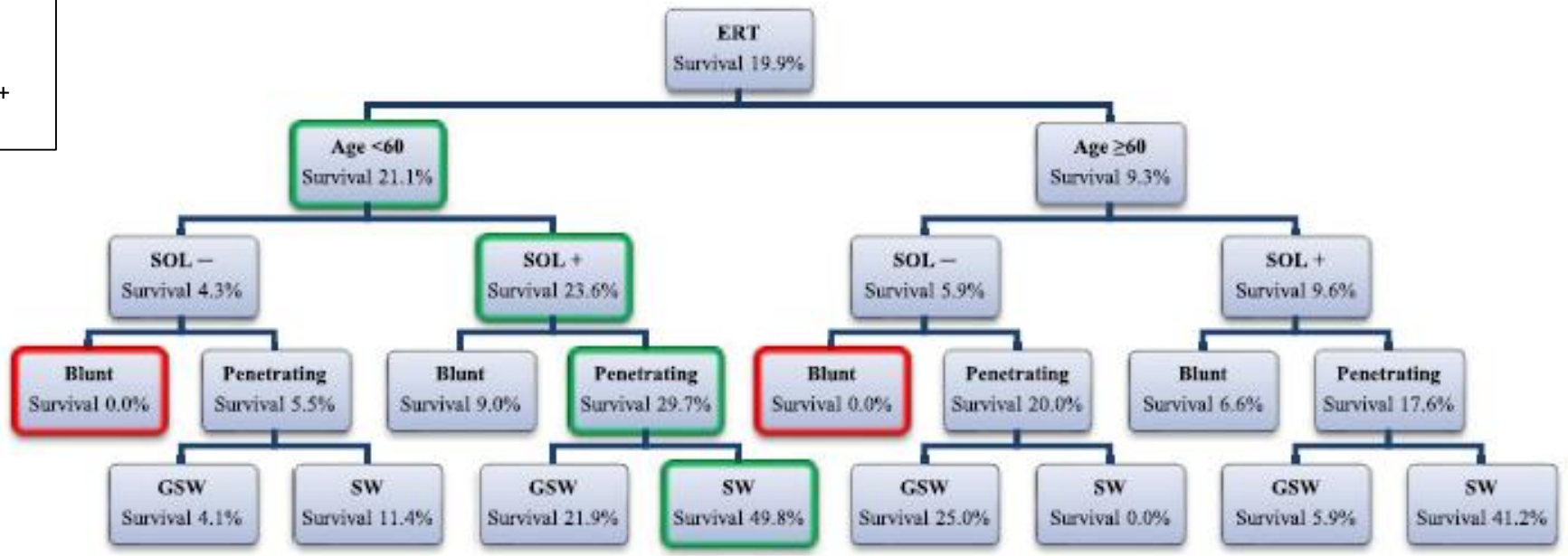


Fig. 3 – Survival in ERT patients based on age, SOL, and injury mechanism. SOL+: Presenting with signs of life to the ED; SOL–: Presenting without signs of life to the ED. (Color version of figure is available online.)

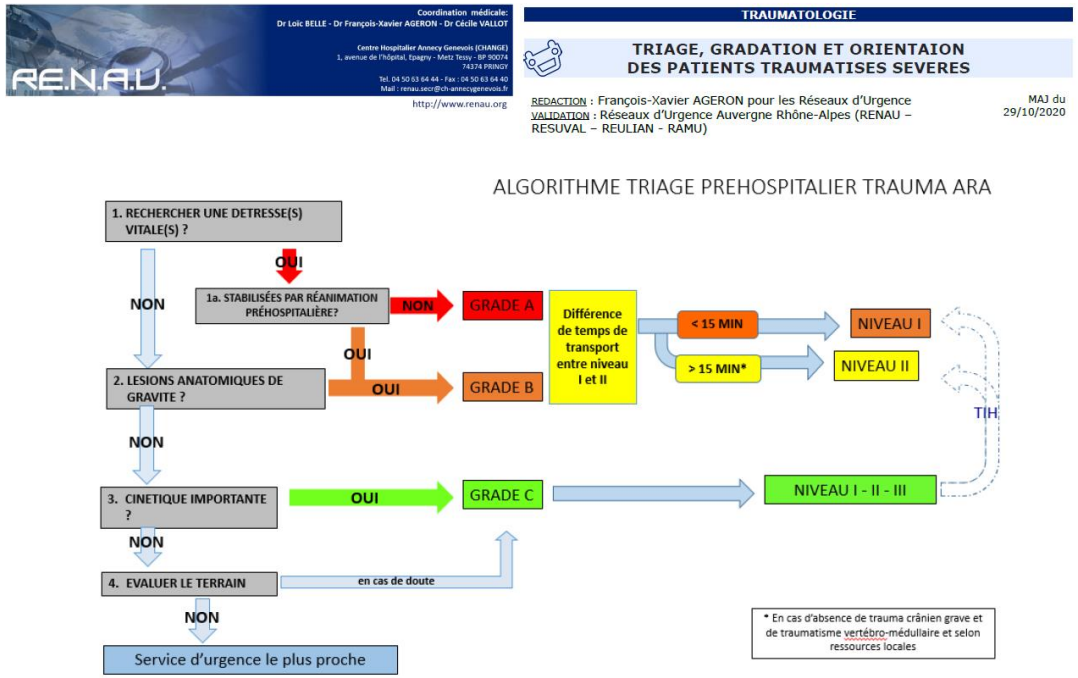
- Donc

- Meilleurs résultats que littérature plus ancienne (<10%)
- Meilleure sélection de patients avec le temps

- Modification protocoles actuels ?
  - ACR traumatique :
    - <5’ trauma fermé
    - <15’ trauma pénétrant

- Attention ≠ thoracostomie +
- Place du REBOA dans tout ça…

5) Triage pré hospitalier



Gianola et al. World Journal of Emergency Surgery (2021) 16:31
https://doi.org/10.1186/s13017-021-00372-1

World Journal of Emergency Surgery

REVIEW Open Access

Accuracy of pre-hospital triage tools for major trauma: a systematic review with meta-analysis and net clinical benefit

- Sous triage, <5% ACS-COT 2014
  - faible sensibilité de détection des malades graves
  - Morbimortalité évitable
- Sur triage, 25-25%
  - Faible spécificité
  - Engorgement des trauma center

- Question : quelle est le meilleur outil de triage des malades traumatisés sévères en pré hospitalier ?

- Methode : revue systématique sauf USA et Asie
- Trauma grave = ISS>15

- Evaluation :
  - Sensibilité et spécificité
  - Net clinical benefice

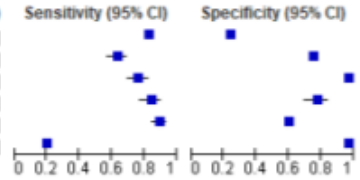
- 13 outils évalués

Index test vs reference standard: ISS > 15

Study ID	INDEX tool	All cases (n trauma patients)	ISS > 15	Under triage (%)	Over triage (%)
Dinh 2012	ASC-COT	2664	285	37	25
Do 2014	ASC-COT	1696	182	24	3
Ocak 2009	ASC-COT	302	151	16	23
Bouzat 2015	ASC-COT	2572	1,185	17.6	76.6
Voskens 2018	Dutch field triage protocol (ACS-COT)	4950	436	21.6	30.6
Voskens 2018 (elderly > 65)	Dutch field triage protocol (ACS-COT)	1085	132	38.6	21.1
van Laarhoven 2014	Dutch field triage protocol (ACS-COT)	1607	221	10.9	39.5
Vinjevoll 2018	New trauma team activation criteria	998	127	-	87
Bouzat 2015	TRENAU	2572	1,185	8.5	58.8
Follin 2016	Vittel Triage Criteria	1160	417	-	64
Sewalt 2016	PHI ≤ 1 of 20	154,476	52,818	38.9	23.7
Sewalt 2016	T-RTS ≤ 11 of 12	154,476	52,818	66.8	8.1
Sewalt 2016	PSS ≤ 11 of 12	154,476	52,818	40.5	21.3
Sewalt 2016	MGAP ≤ 28 of 29	154,476	52,818	31	51.2
Sewalt 2016	mREMS > 3 of 26	154,476	52,818	23.1	72.4
Sewalt 2016	KTS ≤ 15 of 16	154,476	52,818	3.6	82.8

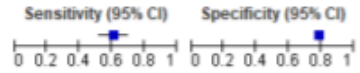
ASC-COT (ISS >15 as reference) in adults

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Bouzat 2015	976	1047	209	340	0.82 [0.80, 0.84]	0.25 [0.22, 0.27]
Dinh 2012	180	587	105	1792	0.63 [0.57, 0.69]	0.75 [0.74, 0.77]
Do 2014	139	45	43	1469	0.76 [0.70, 0.82]	0.97 [0.96, 0.98]
Ocak 2009	127	34	24	117	0.84 [0.77, 0.90]	0.77 [0.70, 0.84]
van Laarhoven 2014	197	547	24	839	0.89 [0.84, 0.93]	0.61 [0.58, 0.63]
Voskens 2018	342	94	1382	3132	0.20 [0.18, 0.22]	0.97 [0.96, 0.98]



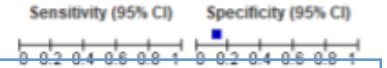
ASC-COT (ISS>15 as reference) in elderly

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Voskens 2018	81	201	51	752	0.61 [0.52, 0.70]	0.79 [0.76, 0.81]



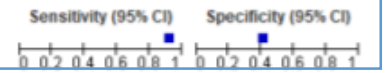
New TTA (ISS>15 as reference) in adults

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Vinjevoll 2018	0	758	0	113	Not estimable	0.13 [0.11, 0.15]



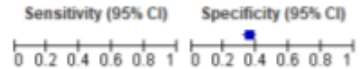
TRENAU (ISS>15 as reference) in adults

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Bouzat 2015	1090	818	95	569	0.92 [0.90, 0.93]	0.41 [0.38, 0.44]



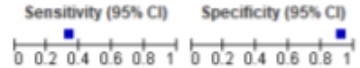
Vittel Triage Criteria (ISS>15 as reference) in adults

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Follin 2016	0	476	0	267	Not estimable	0.36 [0.32, 0.40]



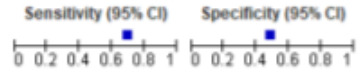
T-RTS ≤12 (ISS>15 as reference) in adults

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Sewalt 2019	17536	8234	35282	93424	0.33 [0.33, 0.34]	0.92 [0.92, 0.92]



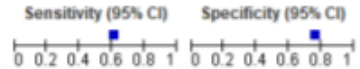
MGAP ≤28 (ISS >15 as reference) in adults

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Sewalt 2019	36444	52049	16374	49609	0.69 [0.69, 0.69]	0.49 [0.48, 0.49]



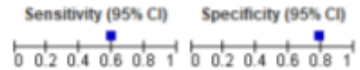
PHI ≥ 1 (ISS>15 as reference) in adults

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Sewalt 2019	32272	24093	20546	77565	0.61 [0.61, 0.62]	0.76 [0.76, 0.77]



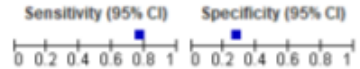
PSS≤11 (ISS>15 as reference) in adults

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Sewalt 2019	31427	21653	21391	80005	0.60 [0.59, 0.60]	0.79 [0.78, 0.79]



mREMS >3 (ISS>15 as reference) in adults

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Sewalt 2019	40617	73600	12201	28058	0.77 [0.77, 0.77]	0.28 [0.27, 0.28]



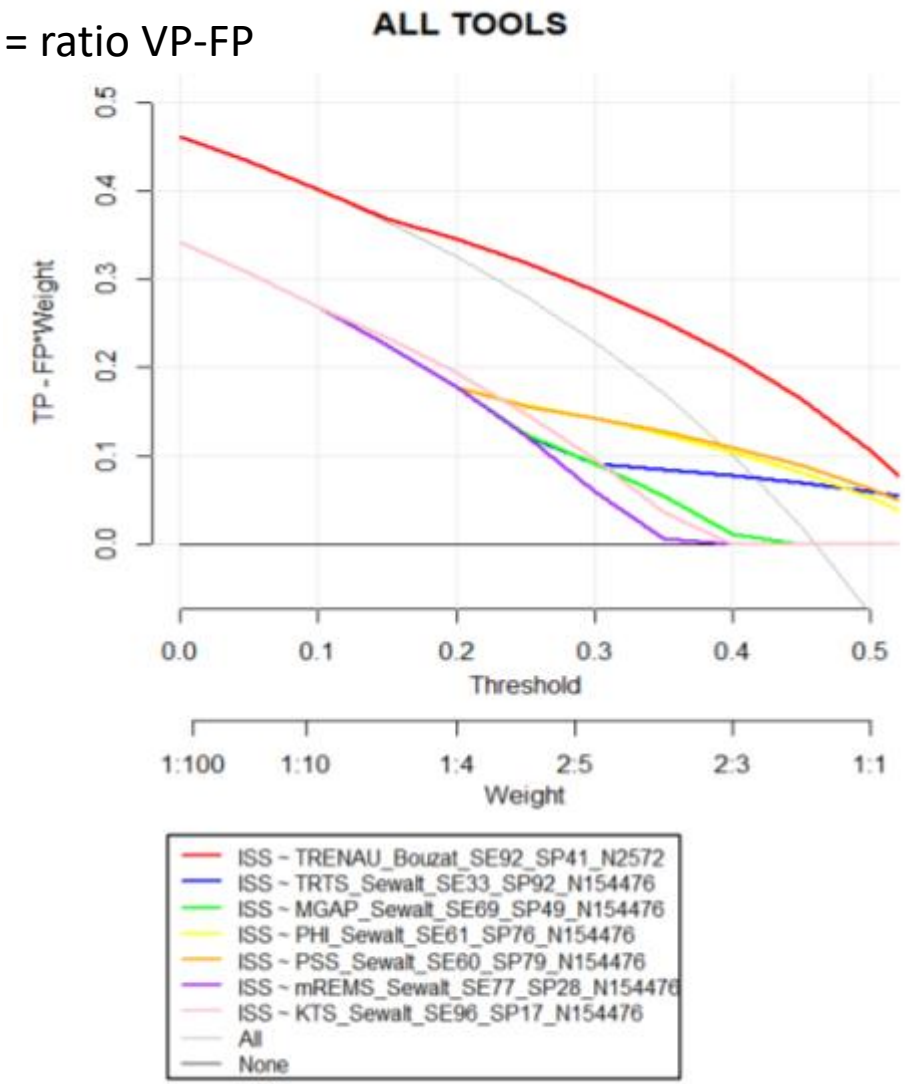
KTS ≤15 (ISS>15 as reference) in adults

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Sewalt 2019	50917	84173	1901	17485	0.96 [0.96, 0.97]	0.17 [0.17, 0.17]

Net clinical benefice

- Représente le gain potentiel lié à l'utilisation de l'outil de triage par rapport au fait d'envoyer tout le monde vers niveau I
- Analyse décisionnelle où l'effet indésirable est rapporté à l'échelle du bénéfice par un facteur de correction

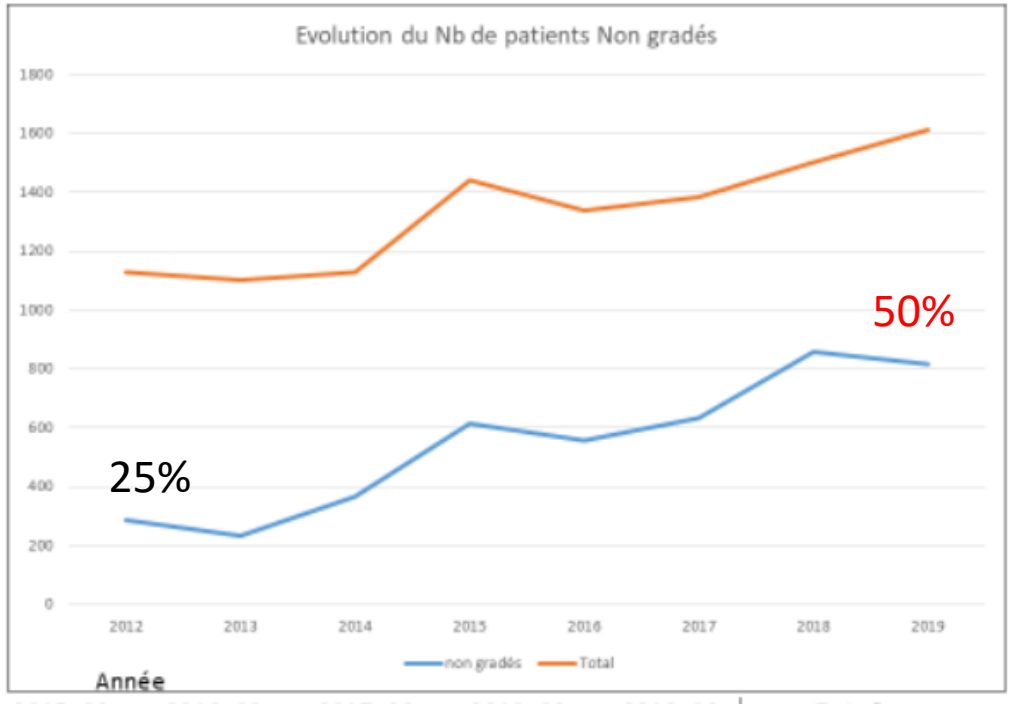
Bénéfice
= ratio VP-FP



Ratio VP/FN

Donc :

- Outils de triage très performant
- Dispatching efficace…
- …sous réserve d'une gradation suffisante !



Merci pour votre attention

- Et merci aux internes du DCA pour la veille biblio ☺