TRAUMABASE

TRéHAUT

CHU LILLE

Prise en charge du polytraumatisé

Delphine Huet garrigue

GIHP Groupe d'intérêt en hémostase péri-opératoire

SFAR

Conflits d’intérêts

LFB
Octapharma
Chugai
Boehringer-Ingelheim
Bayer
Astra zeneca

The NEW ENGLAND JOURNAL of MEDICINE

REVIEW ARTICLE

Edward W. Campion, M.D., *Editor*

Initial Care of the Severely Injured Patient

David R. King, M.D.

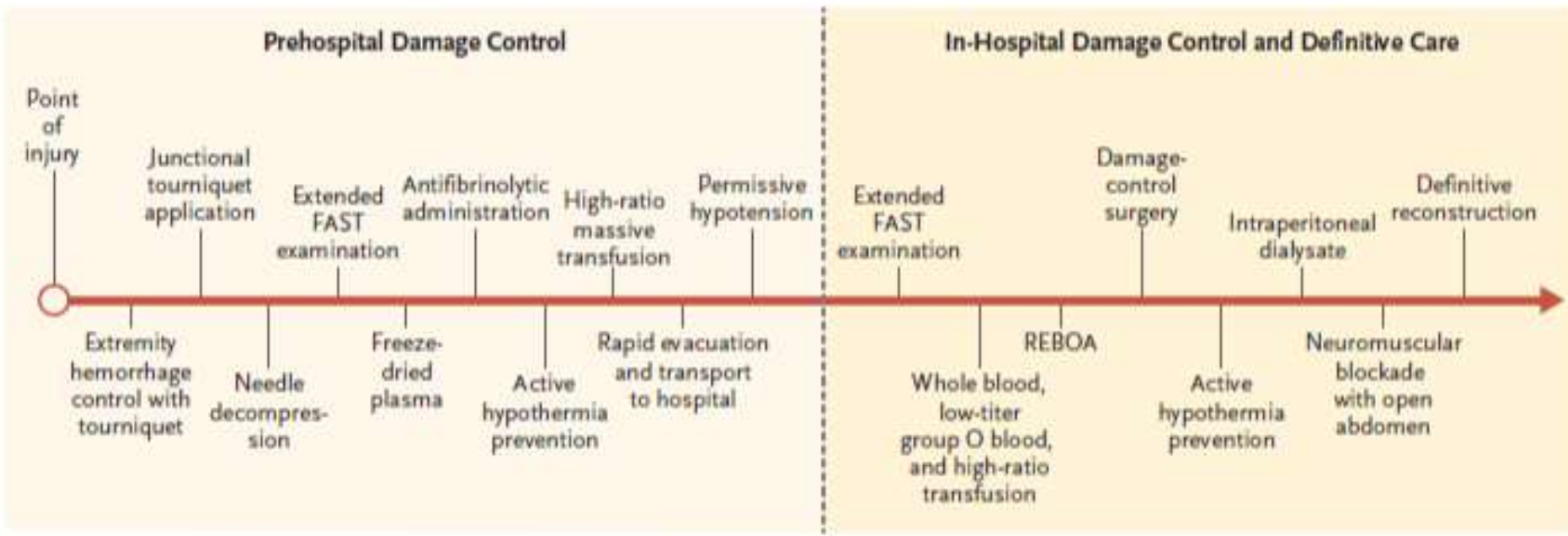


Figure 1. Possible Interventions during the Golden Hour.

The primary purpose of the golden hour concept is to achieve early hemorrhage control. Prehospital and in-hospital maneuvers toward this goal include initial care, triage, rapid evacuation, and resuscitation. FAST denotes focused abdominal sonography for trauma, and REBOA resuscitative endovascular balloon occlusion of the aorta.

World Health Organization

Problème majeur de santé publique
1 décès sur 10
5,8 millions de morts par an

ELSEVIER
Available online at ScienceDirect www.sciencedirect.com
Elsevier Masson France EM|consulte www.em-consulte.com/en
Journal Surgery

ORIGINAL ARTICLE

Preventable deaths in a French regional trauma system: A six-year analysis of severe trauma mortality

Journal of Visceral Surgery (2018) Girard E for the TRENAU group

Causes de décès	Toutes n = 503	EVITABLES n = 108
Trauma cranien	347 (69%)	20 (19%)
Choc hémorragique	87 (17%)	60 (56%)
SDMV	34 (7%)	13 (12%)
Respiratoire	19 (4%)	8 (7%)
Cardiaque	10 (2%)	4 (4%)
Choc septique	6 (1%)	3 (3%)

7484 trauma

503 décès (6,7%), 170 erreurs

Hémorragie incontrôlable

« Morts potentiellement évitables »

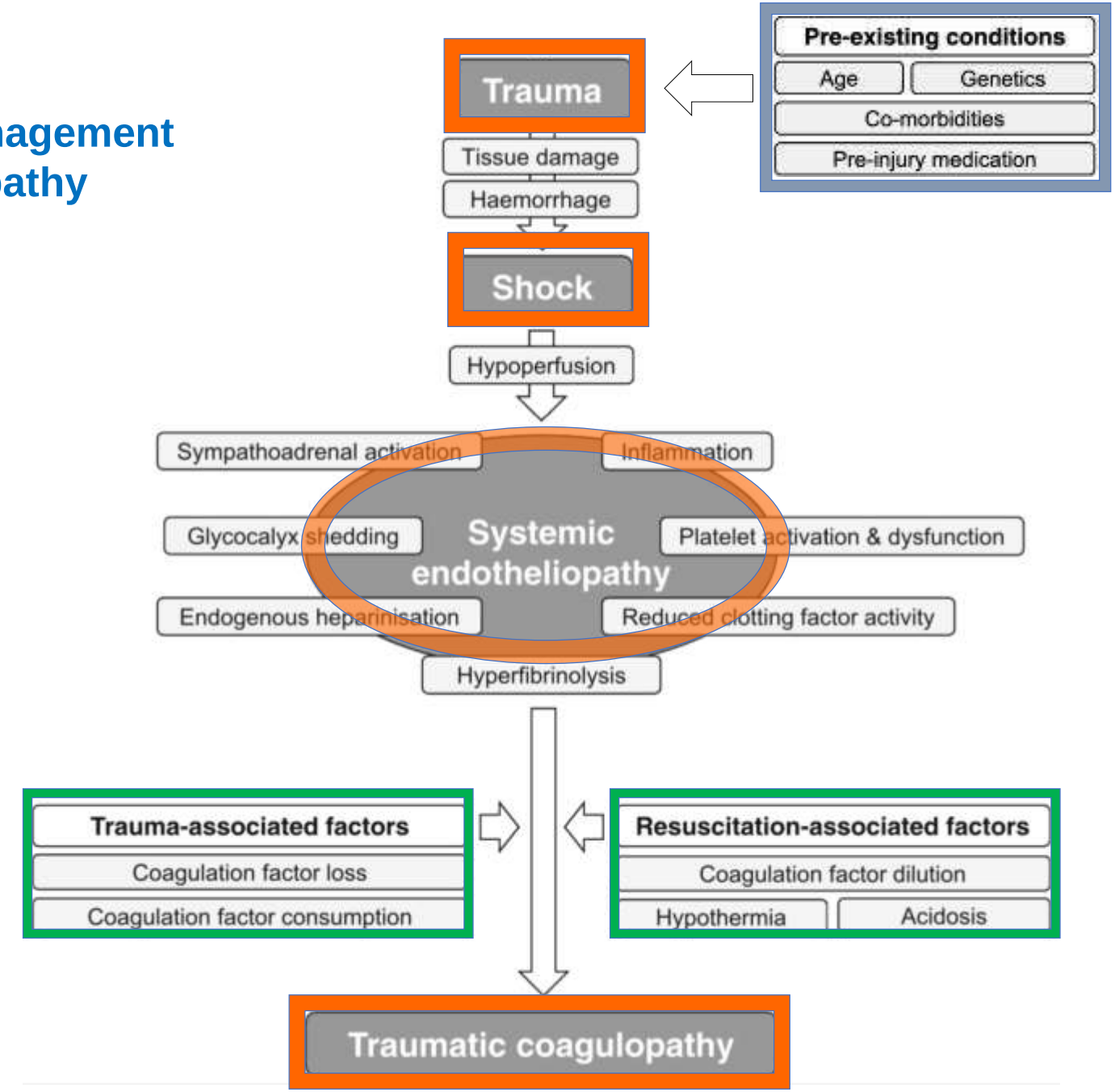
CRITICAL CARE 2019

The European guideline on management of major bleeding and coagulopathy following trauma: fifth edition

Spahn DR et al.

Coagulopathie :

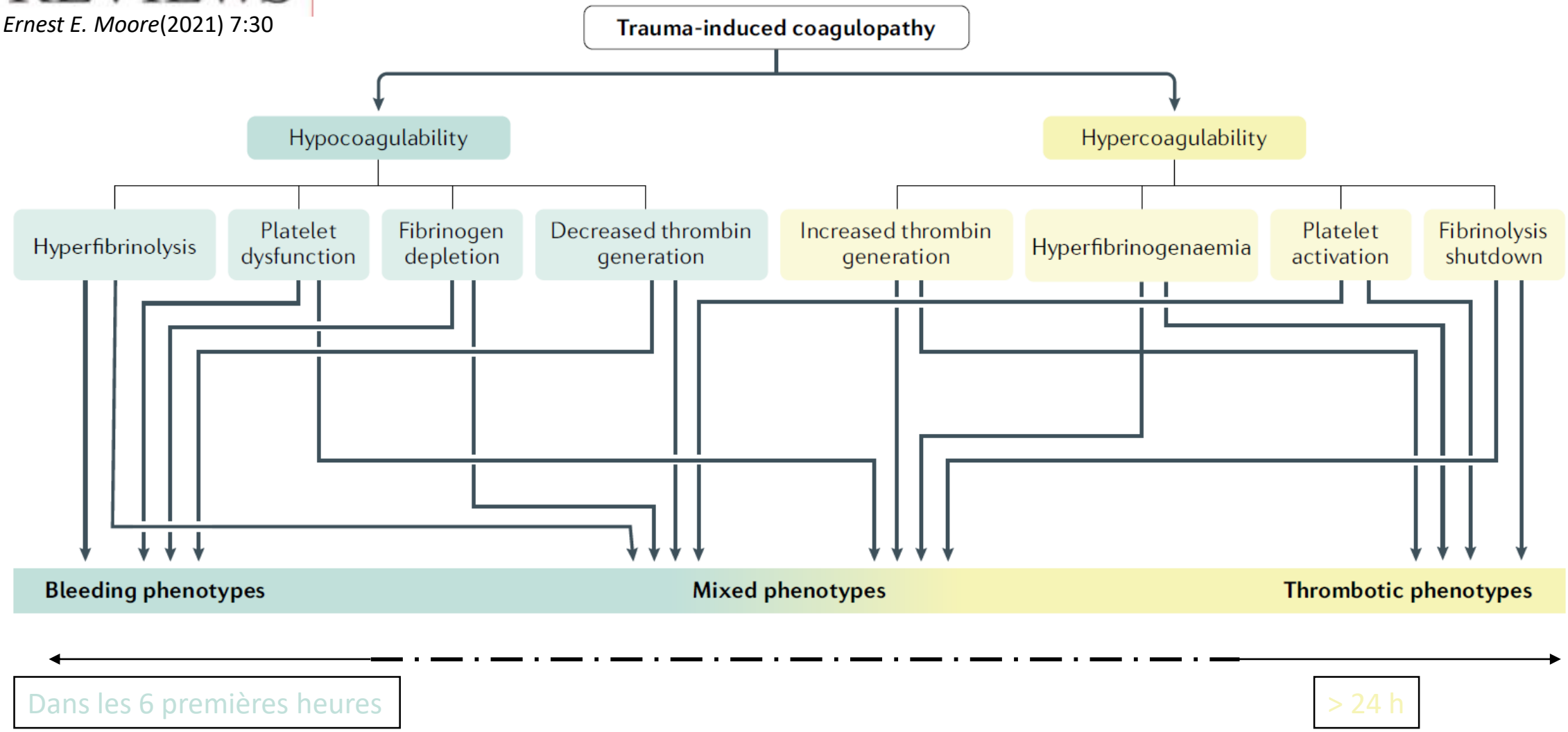
- Plusieurs phénotypes
- Complexe
- Evolutive



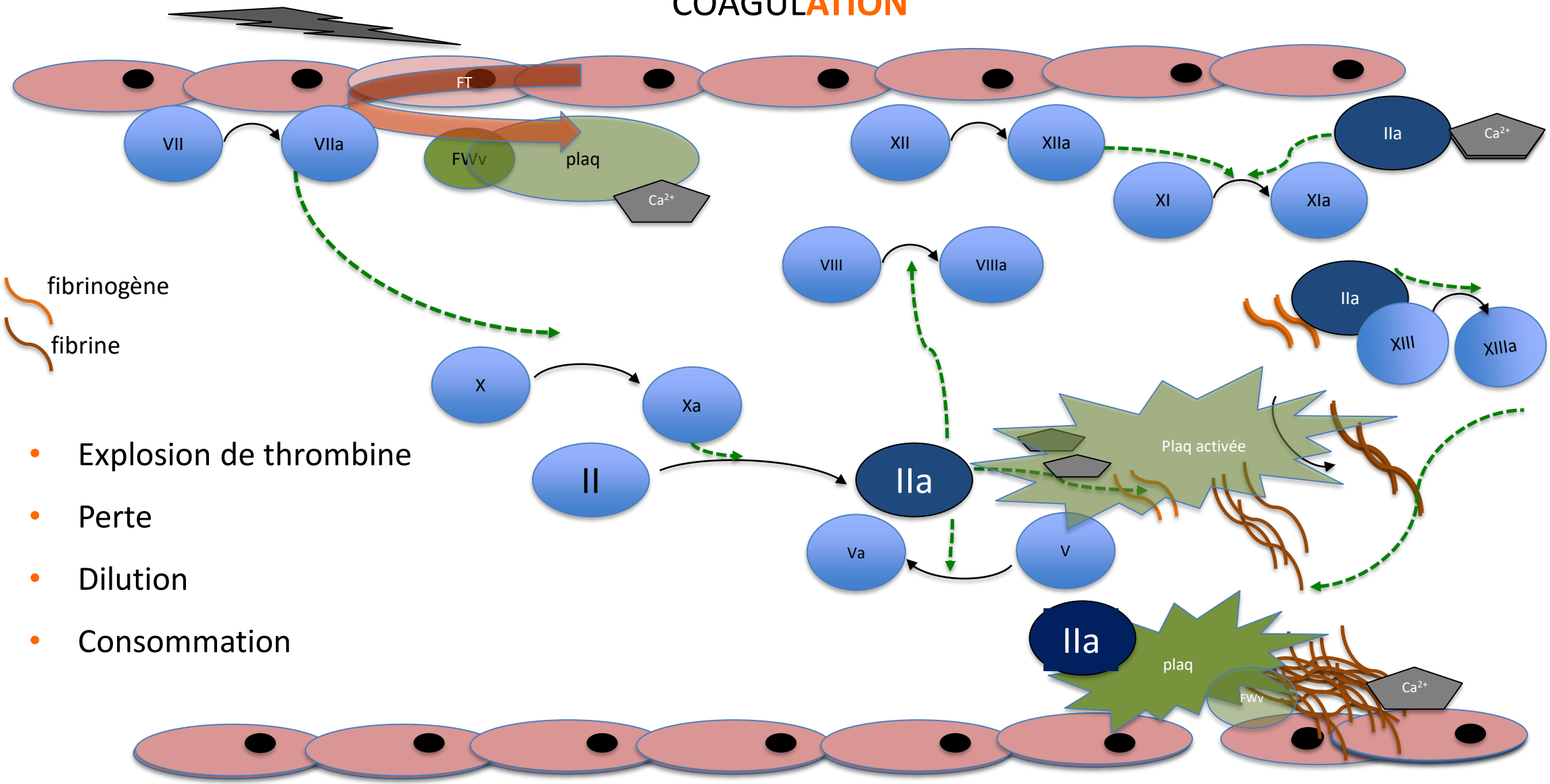
nature REVIEWS

Ernest E. Moore(2021) 7:30

Coagulopathie aigue traumatique



COAGULATION

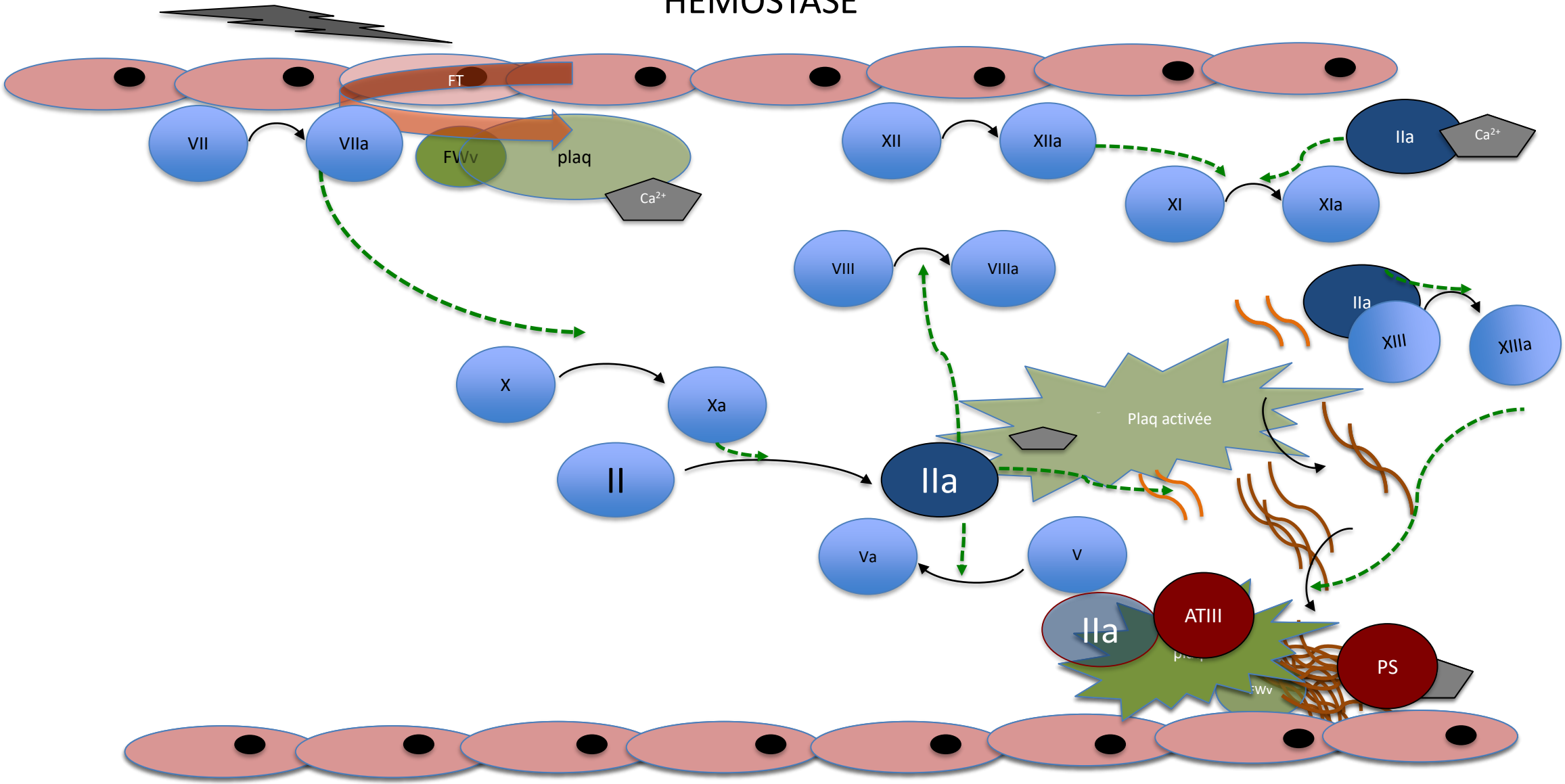


- Explosion de thrombine
- Perte
- Dilution
- Consommation

Hémostase primaire : adhésion, activation et agrégation plaquettes = Clou plaquettaire

Hémostase secondaire = coagulation = fibrinogène soluble en fibrine insoluble = caillot

HEMOSTASE

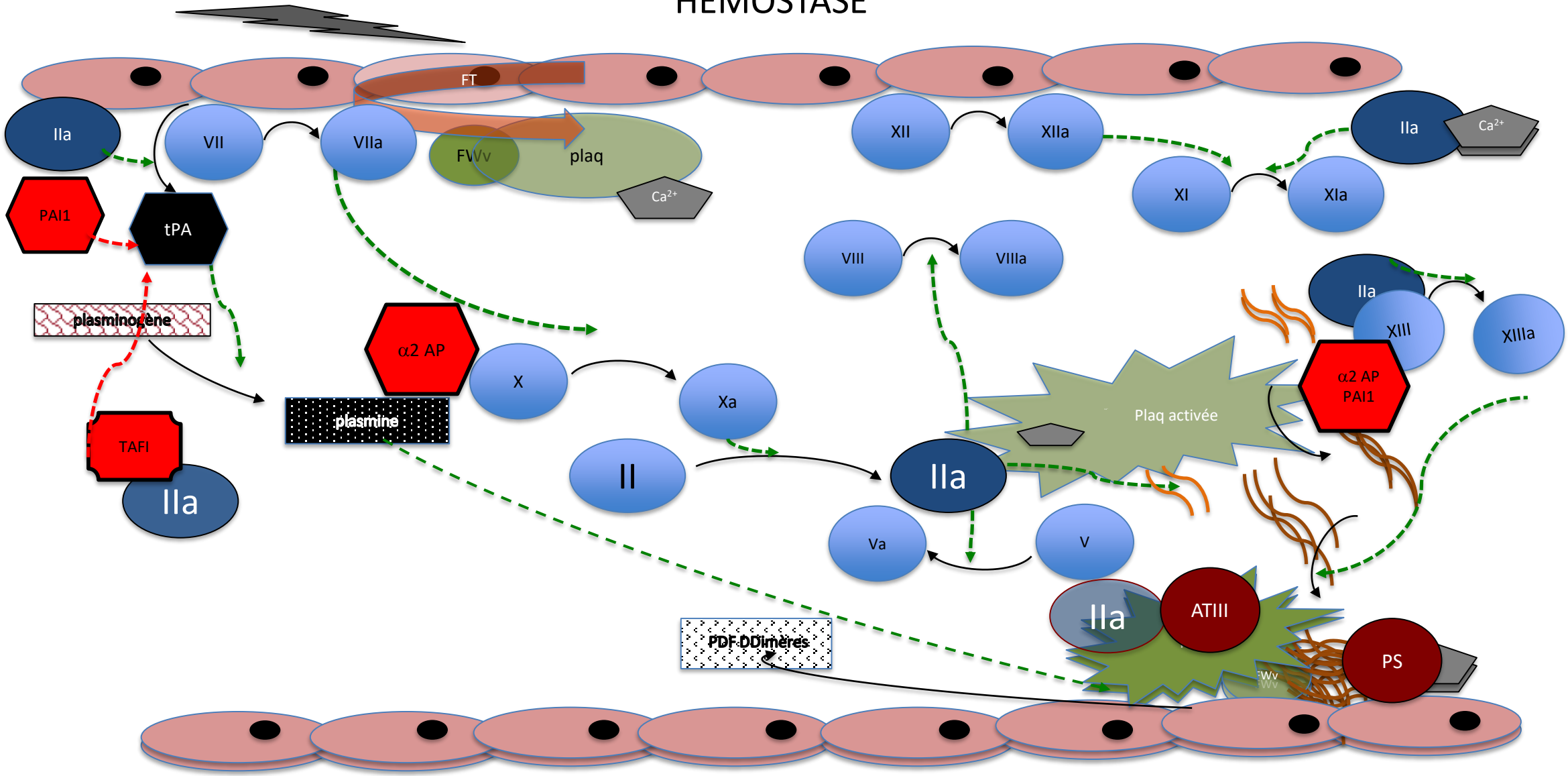


Hémostase primaire : adhésion, activation et agrégation plaquettes = Clou plaquettaire

Hémostase secondaire = coagulation = fibrinogène soluble en fibrine insoluble = caillot

Régulation de la coagulation : Anticoagulation

HEMOSTASE

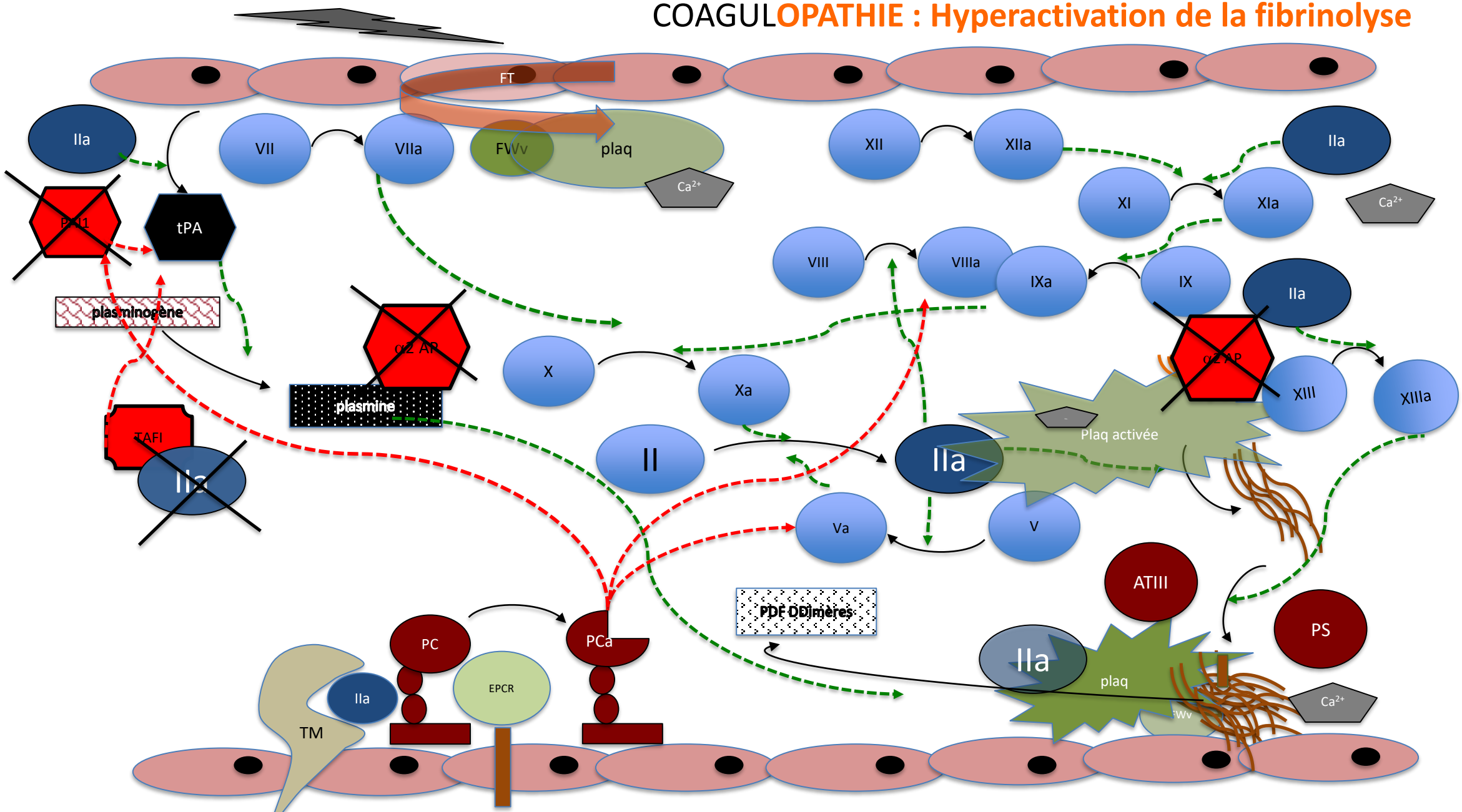


Hémostase primaire : adhésion, activation et agrégation plaquettes = Clou plaquettaire

Hémostase secondaire = coagulation = fibrinogène soluble en fibrine insoluble = caillot

FIBRINOLYSE = Destruction du caillot

COAGULOPATHIE : Hyperactivation de la fibrinolyse



Brohi K, Cohen MJ, Ganter MT et al. Acute traumatic coagulopathy : initiated by hypoperfusion : modulated through the protein C pathway ? Ann Surg 2007,245 :812-818.

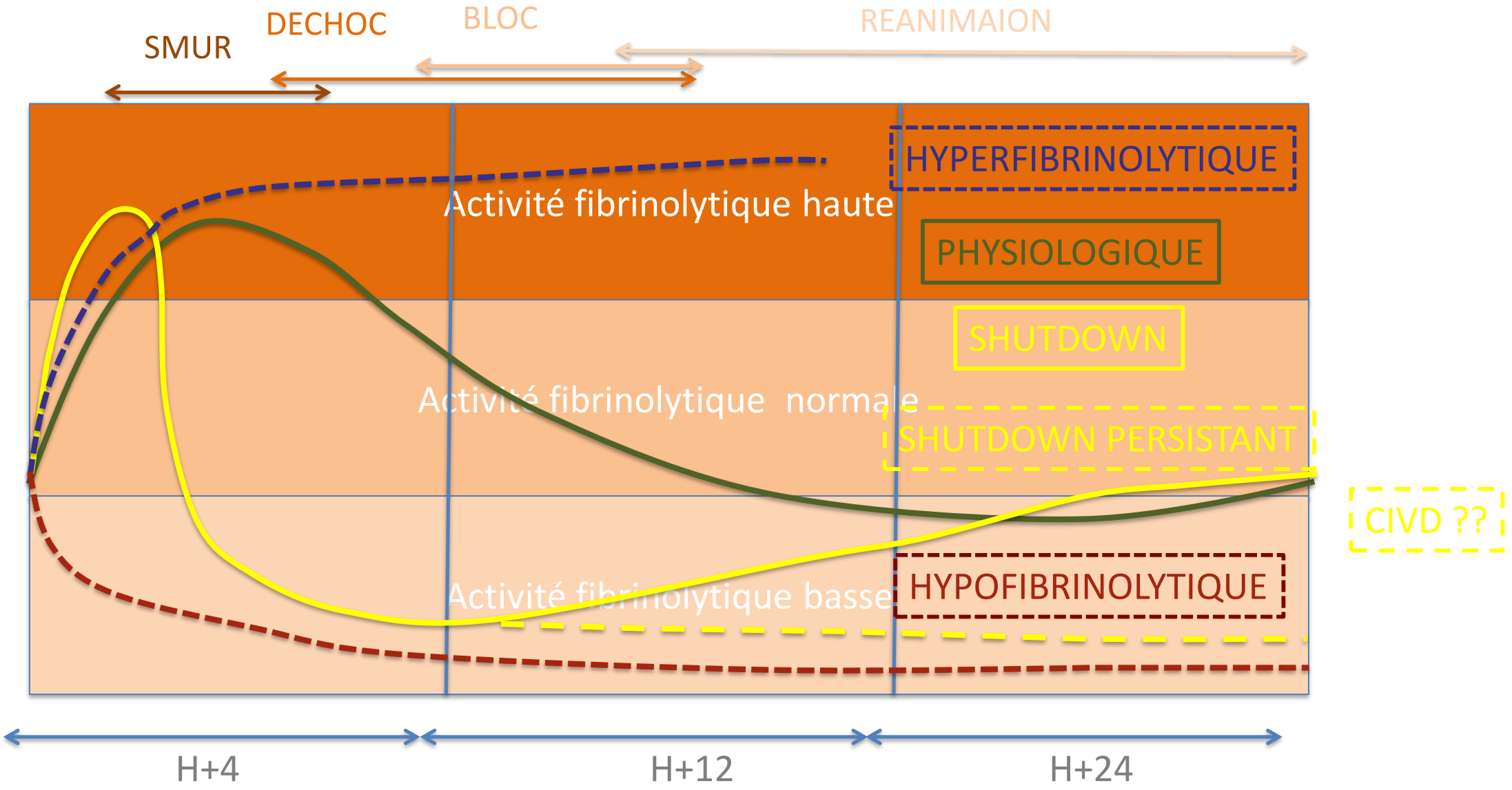
Davenport RA, Guerreiro M, Frith D et al. Activated protein C drives the hyperfibrinolysis of acute traumatic coagulopathy. Anesthesiology 2017,126 :115-27.

Gando S, Mayumi T and Ukai T. Actyivated protein C plays no major roles in the inhibition of coagulation or increased fibrinolysis in acute coagulopathy of trauma-shock : a systemic review. Thromb J 2018 ;16 :13

Meledeo MA, Herzig MC, Bynum JA et al. Acute traumatic coagulopathy : the elephant in a room of blind scientists. J Trauma Acute Care Surg 2017 ; 82(66) :33-40

Profils fibrinolytique par TEG/TEM

Moore HB et al. Anesth Analg. 2019 Sep;129(3):762-773
Roberts DJ et al. J Trauma Acute Care Surg 2019 ;86(2) :206-13
Roberts I et al. Transfusion 2016,56:115-8.



The European guideline on management of major bleeding and coagulopathy following trauma: fifth edition

Donat R. Spahn[1], Bertil Bouillon[2], Vladimir Cerny[3,4,5,6], Jacques Duranteau[7], Daniela Filipescu[8], Beverley J. Hunt[9], Radko Komadina[10], Marc Maegele[11], Giuseppe Nardi[12], Louis Riddez[13], Charles-Marc Samama[14], Jean-Louis Vincent[15] and Rolf Rossaint[16*]

BioMed Central The Open Access Publisher
CRITICAL CARE
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V. Initial management of bleeding and coagulopathy

Antifibrinolytic agents

Recommendation 22 We recommend that TXA be administered to the trauma patient who is bleeding or at risk of significant haemorrhage as soon as possible and within 3 hours of injury at a loading dose of 1 g infused over 10 minutes followed by an i.v. infusion of 1 g over 8 h. (Grade 1A)

We recommend that protocols for the management of bleeding patients consider administration of the first dose of TXA en route to the hospital. (Grade 1C)

We recommend that the administration of TXA not await results from a viscoelastic assessment. (Grade 1B)

Acide TRANEXAMIQUE

Recommandations ?

GUIDELINES Open Access

The European guideline on management of major bleeding and coagulopathy following trauma: sixth edition

En intra-hospitalier

GUIDELINES Open Access

The European guideline on management of major bleeding and coagulopathy following trauma: sixth edition

R25
Initial coagulation resuscitation

***

The initial coagulation resuscitation strategy for patients with expected massive haemorrhage should comprise either:
fibrinogen concentrate or cryoprecipitate and pRBC
OR
FFP or pathogen-inactivated FFP in a FFP:pRBC ratio of at least 1:2 as needed.
A high platelet:pRBC ratio may be applied.

Thérapie « ratio »

GUIDELINES Open Access

The European guideline on management of major bleeding and coagulopathy following trauma: sixth edition

R25
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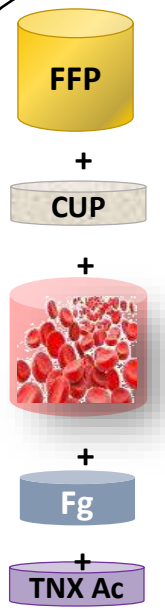
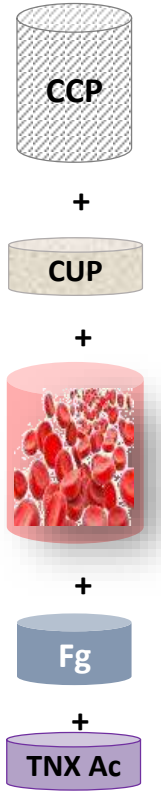


- **PT < 1.5N**
- **Ratio 1:1-> 1:2**
- **Plaquettes 50-100.000/mm³**
- **Hemoglobine 7-9 g/dL**
- **Fibrinogène > 1.5 g/L (1C)**
- **TXA < 3h ++**

Holcomb JB et al. JAMA 2015; PROPPR study*
Duranteau J et al. RFE SFAR 2016
Spahn DR et al . Crit Care 2019



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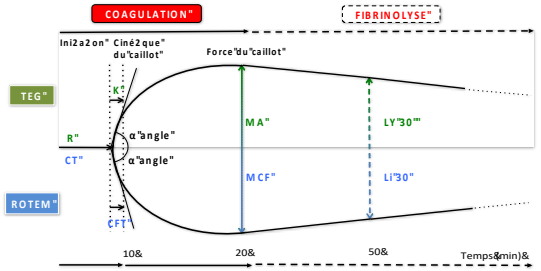
Thérapie individualisée



Paramètre mesuré	Paramètre de l'hémostase	Traitement proposé
R-time/CT (min)	Facteurs de la coagulation	Si ↗ : PFC ou CPP
Angle α (°)	Cinétique de la formation de fibrine (Fg)	Si ↘ : Fg
MA/MCF (mm)	Fg, plaquettes (nombre et fonction), FXIII	Si ↘ : Fg/ plaquettes
LY30/ LI30 (%)	Lyse du caillot 30' après MA (Fibrinolyse)	Si↗ : Acide Tnx
MA-FF/FIBTEM	Fibrinogène « fonctionnel »	Si ↘ : Fg

Spahn DR, et al. Crit Care 2019
Gonzales et al. Ann Surg, 2016

Augmenter les ratios ne suffit pas…

1:1:1

Ratio : variable temps-dépendante

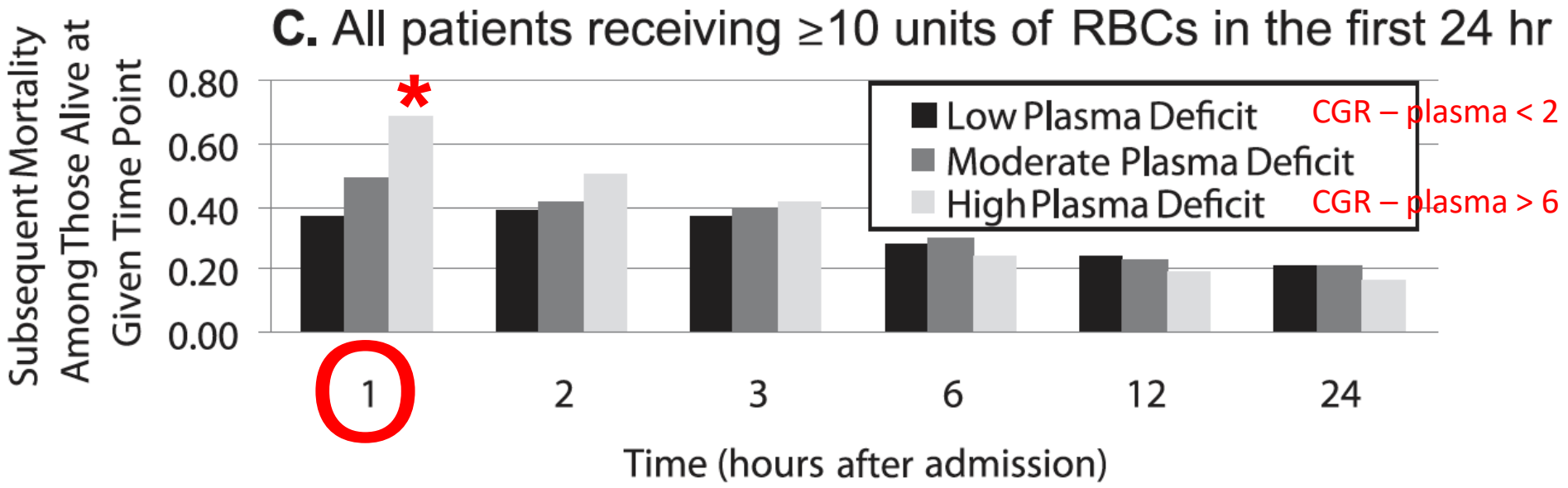
t

Blood product use in trauma resuscitation: plasma deficit versus plasma ratio as predictors of mortality in trauma

TRANSFUSION
2011;51:1925-1932.

Andreas R. de Biasi, Lynn G. Stansbury, Richard P. Dutton, Deborah M. Stein, Thomas M. Scalea, John R. Hess

Ratio= nbr PFC/nbr CGR → Déficit=nbr CGR-nbr PFC



Mortalité en fonction du déficit au cours des 24 1ères heures

Blood product use in trauma resuscitation: plasma deficit versus plasma ratio as predictors of mortality in trauma

TRANSFUSION
2011;51:1925-1932.

Andreas R. de Biasi, Lynn G. Stansbury, Richard P. Dutton, Deborah M. Stein, Thomas M. Scalea, John R. Hess

Déficit en plasma à 3h = augmentation des besoins en CGR

	Low deficit	Moderate deficit	High deficit	P[1]
Patients, number (%)	57	64	33	
RBC use at 24 hours, mean (SD)	9.9(4.4)	12.6(8.5)	23.8(19.3)	<0.001
Plasma use at 24 hours, mean (SD)	9.4(5.5)	8.3(8.1)	12.6(16.9)	<0.001
Probability of survival[2]	0.537(0.180)	0.511(0.181)	0.474(0.180)	0.3
Deaths (%)	20(35.1)	25(39)	21(63.6)	0.02

1 Probability of no true difference between plasma status groups by Analysis of Variance F statistic for continuous and Chi square for categorical variables
2 Probability of Survival: Trauma Revised Injury Severity Score, TRISS

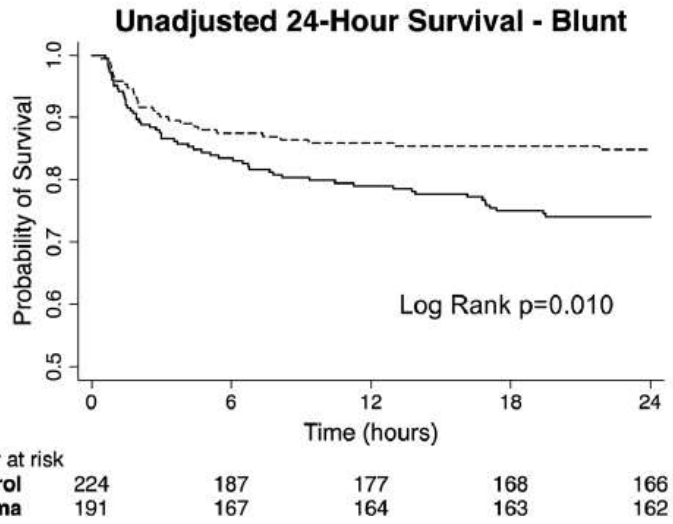
Augmentation de la probabilité de survie (TRISS) par apport précoce de PFC avec besoin en CGR diminué indépendamment de l'ISS

J Trauma Acute Care Surg
Volume 88, Number 1

Prehospital plasma in injured patients is associated with survival principally in blunt injury: Results from two randomized prehospital plasma trials

PAMPer-501 patients, COMBAT-125 patients; total N = 626

C



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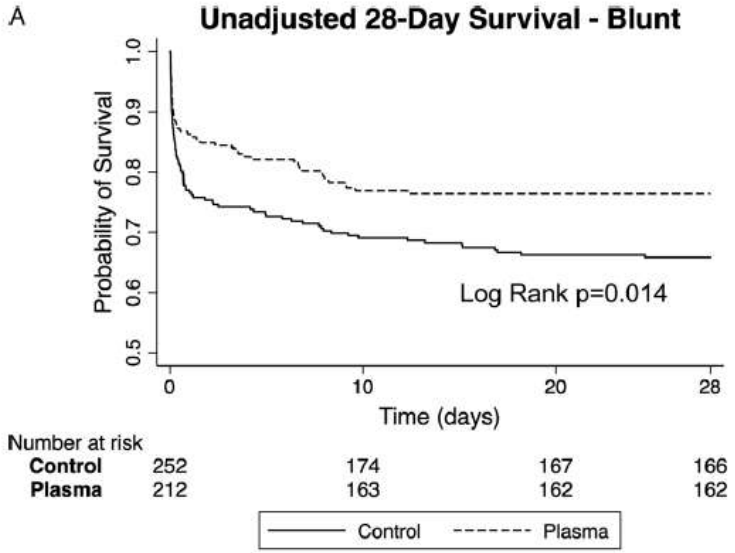

Après ajustement, en analyse multivariée benefice de survie à 24 h (HR, 0.59; 95% confidence interval [CI], 0.370–0.947;p = 0.029)

Produits disponibles à la phase précoce

1. CCP (Concentrés de Complexes Prothrombiniques)
2. Sang total
3. Plasmas lyophilisés
4. PFC décongelés
5. Plasma médicament

JAMA Network™

From: **Efficacy and Safety of Early Administration of 4-Factor Prothrombin Complex Concentrate in Patients With Trauma at Risk of Massive Transfusion: The PROCOAG Randomized Clinical Trial**

JAMA. Published online March 21, 2023. doi:10.1001/jama.2023.4080

CCP

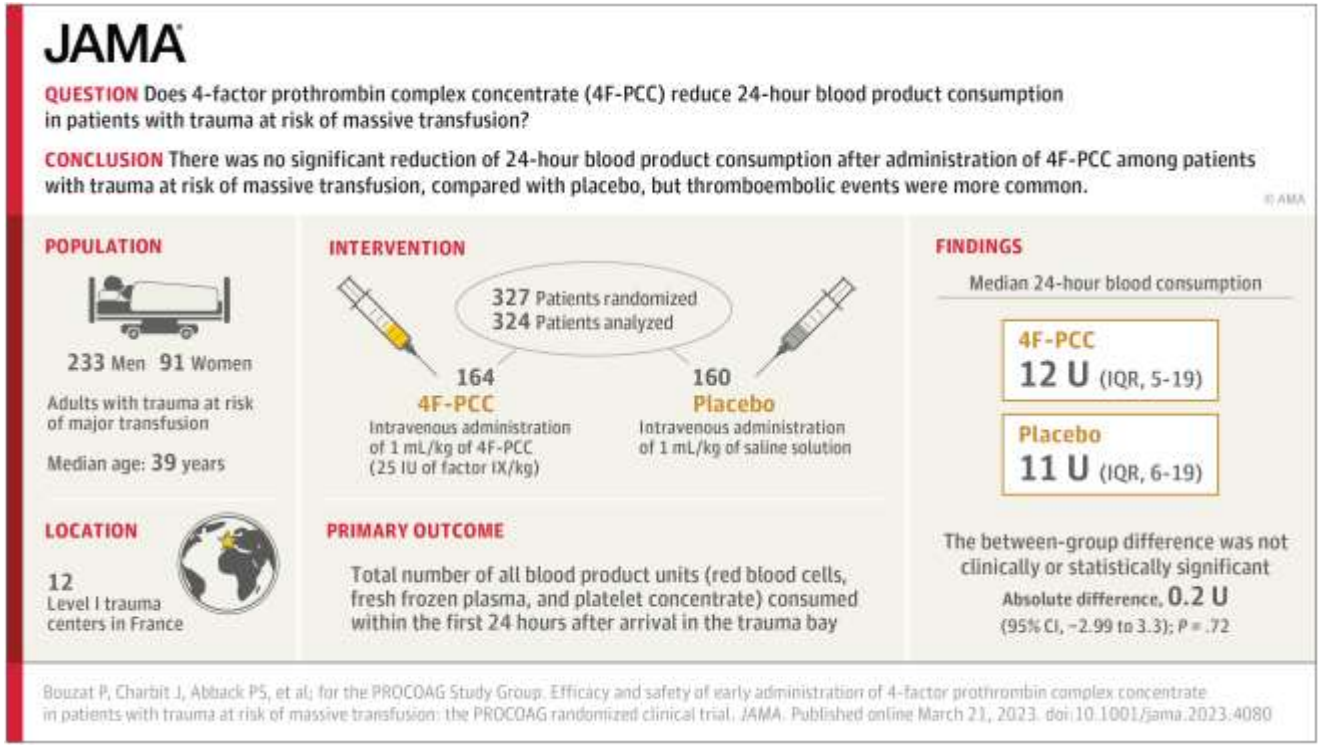

Figure Legend:

Early Administration of 4-Factor Prothrombin Complex Concentrate in Patients With Trauma

JAMA Network™

From: **Efficacy and Safety of Early Administration of 4-Factor Prothrombin Complex Concentrate in Patients With Trauma at Risk of Massive Transfusion: The PROCOAG Randomized Clinical Trial**

JAMA. Published online March 21, 2023. doi:10.1001/jama.2023.4080

Table 3. Thromboembolic Events by Treatment Group

Thromboembolic event	No. (%) 4F-PCC (n = 164)	No. (%) Placebo (n = 160)	Absolute difference (95% CI), %[a]	Relative risk (95% CI)	*P* value[b]
Patients with at least 1 thromboembolic event, No. (%) [No.]	56 (35) [161]	37 (24) [157]	11 (1 to 21)	1.48 (1.04 to 2.10)	.03
Superficial venous thrombosis	5 (3.1)	1 (0.6)	2 (−1 to 5)		
Deep venous thrombosis	27 (16.8)	23 (14.6)	2 (−6 to 10)		
Pulmonary embolism	20 (12.4)	17 (10.8)	2 (−5 to 9)		
Stroke[c]	2 (1.2)	0	1 (−1 to 3)		
Other[d]	9 (5.6)	5 (3.2)	2 (−2 to 7)		

Abbreviation: 4F-PCC, 4-factor prothrombin complex concentrate.

[a] Absolute differences were not adjusted.

[b] χ^2 test was used for the comparison.

[c] Stroke was diagnosed using cerebral contrast-enhanced computed tomography.

[d] Other includes extremity ischemia (n = 11), thrombosis of venous surgical anastomosis (n = 2), and mesenteric infarction (n = 1). There were no incidents of myocardial infarction in either group.

Table Title:

Thromboembolic Events by Treatment GroupAbbreviation: 4F-PCC, 4-factor prothrombin complex concentrate.

[a] Absolute differences were not adjusted.

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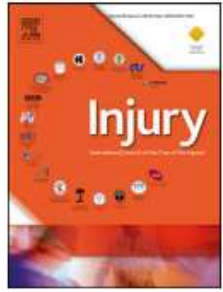
[d] Other includes extremity ischemia (n = 11), thrombosis of venous surgical anastomosis (n = 2), and mesenteric infarction (n = 1). There were no incidents of myocardial infarction in either group.

Effectiveness and safety of whole blood compared to balanced blood components in resuscitation of hemorrhaging trauma patients - A systematic review



Sang total

Highlights

- Whole blood has the advantages of simplifying resuscitation logistics, correcting ratios of components, reducing preservative volumes and allowing transfusion of younger red blood cells.
- Experience with whole blood administration is well documented and appears safe.
- Compared to component resuscitation, whole blood was not associated with better survival or decreases blood product utilization.
- Use of whole blood was not associated with an increase in transfusion reactions and carries significant logistic benefits.

M Mlkin and al. Injury 2021, 52(2)

Recommandations pour la Pratique Professionnelle

Société Française d'Anesthésie et de Réanimation

INDICATIONS DE TRANSFUSION DE PLASMAS LYOPHILISES (PLYO) CHEZ UN PATIENT EN CHOC HEMORRAGIQUE OU A RISQUE DE TRANSFUSION MASSIVE EN MILIEU CIVIL

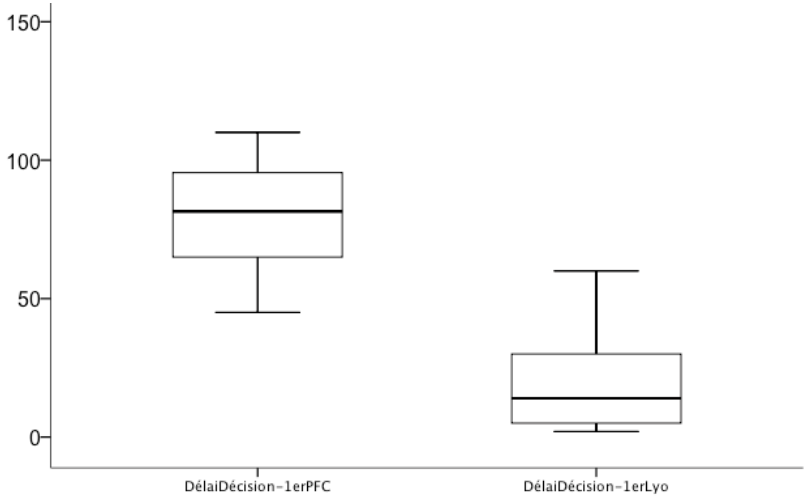
en association avec les sociétés : SFMU, ADARPEF, CARO, CNCRH, CTSA, EFS, GFRUP, GIHP, Samu Urgences de France, SSA

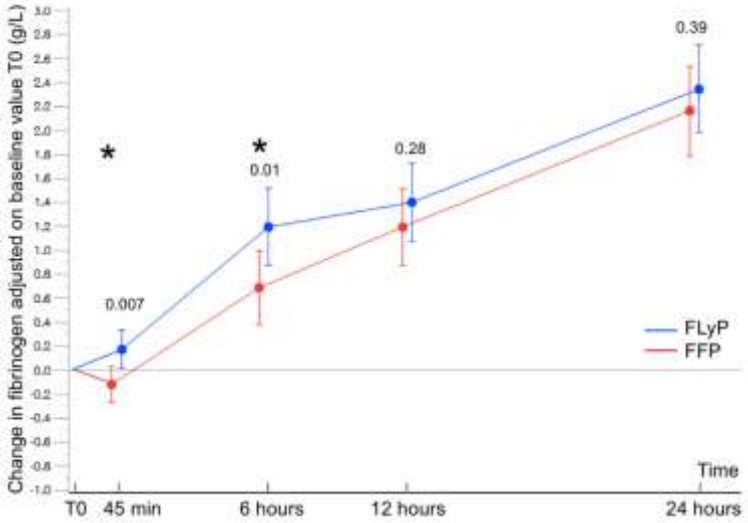
Auteurs : Garrigue-Huet D, Ausset S, Bliem C, Bouthors AS, Bouzat P, Carlier M, Depil-Duval A, Duracher C, François A, Garrabe E, Godier A, Grivaux Chataigner P, Lefort H, Martinaud C, Mendel I, Milesi C, Pasquier P, Pottecher J, Prunet B, Soulat L, Susen S, Quintard H.

French lyophilized plasma versus fresh frozen plasma for the initial management of trauma-induced coagulopathy: a randomized open-label trial

jth journal of thrombosis and haemostasis
ISTH
Explore this journal >

Avantages : Pas de compatibilité ABO





J Thromb Haemost. 2017 Dec 23.

Legifrance.gouv.fr
LE SERVICE PUBLIC DE LA DIFFUSION DU DROIT

JORF n°0060 du 13 mars 2018
texte n° 17

Décision du 8 février 2018 fixant la liste et les caractéristiques des produits sanguins labiles

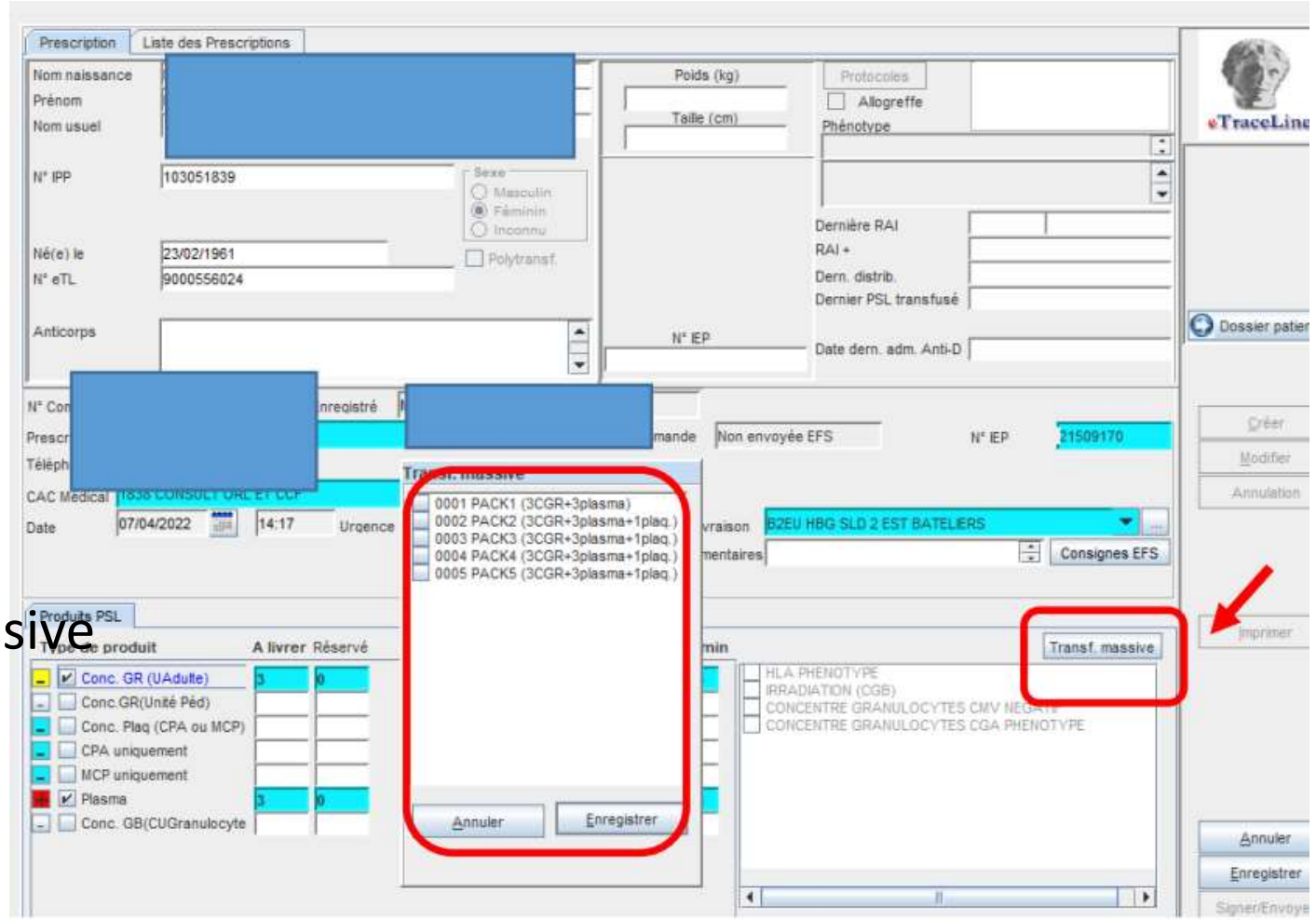
NOR: SSAM1803970S

ELI: https://www.legifrance.gouv.fr/eli/decision/2018/2/8/SSAM1803970S/jo/texte

Décongélation des PFC : Le produit doit être utilisé immédiatement et au plus tard dans les 24 h de décongélation si conservé, à une température entre 2 et 6 °C

Intérêt des décongélation anticipée

Intérêt des protocoles de transfusion massive



Plasma médicament :Octapharma®

Plasma thérapeutique au statut de medicament: sécurité des agents pathogènes

octaplasLG®

octaplasLG® :

- Poche de 200 mL bag contenant 9 - 14 g de proteins issues de plasma humain pour perfusion
- Demi-vie: 4 ans conservé et transporté congelé (à ≤ -18°C)
- Doit être décongelé avant utilisation (au minimum 30 minutes de temps de décongélation)
- Après décongélation , la stabilité physico-chimique à l'usage à été démontrée pour 5 jours à 2-8°C ou 8 heures à temperature ambiante (20-25°C).
- Spécifique des groupes ABO

Forme Lyophilisée adaptée aux situations d'urgence et les situations en dehors de l'hôpital

Forme Lyophylisée

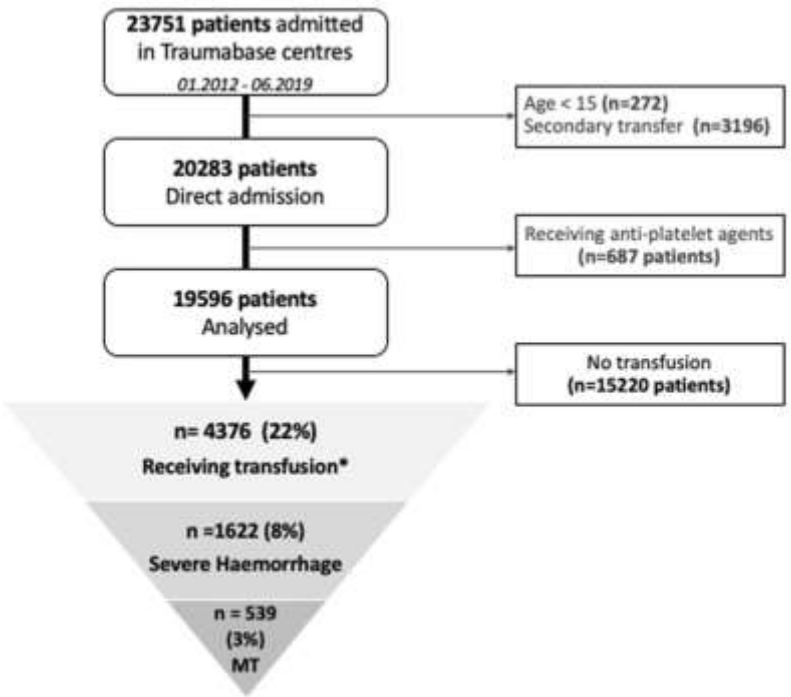
Forme Lyophylisée :

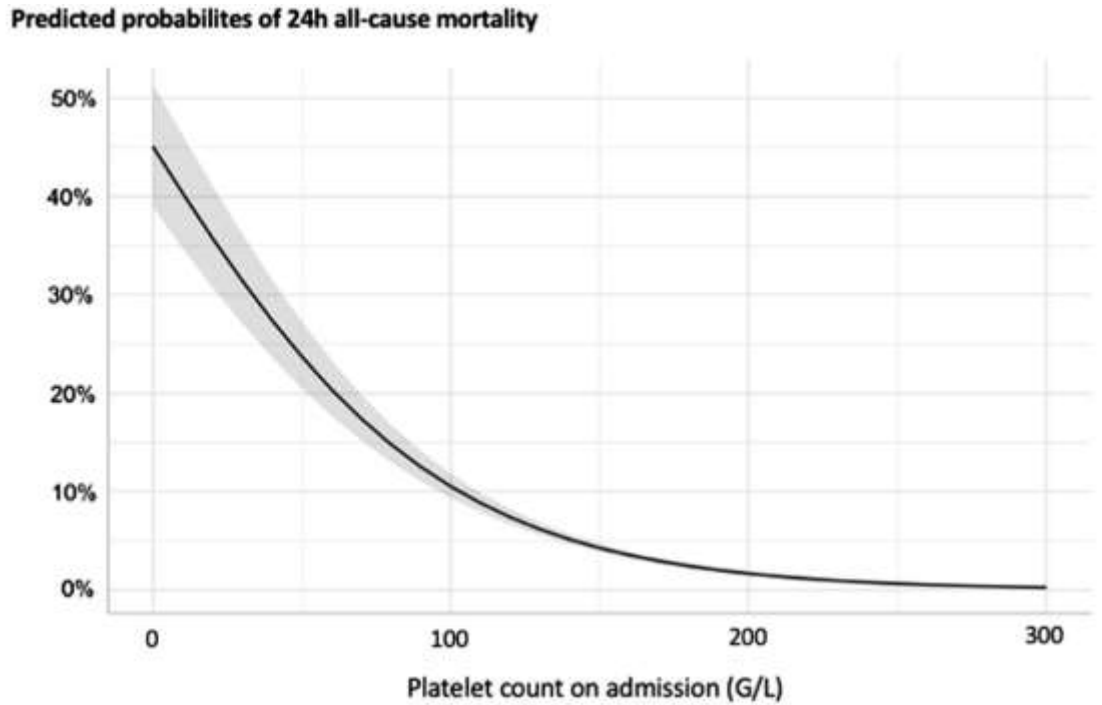
- Flacon contenant 9 - 14 g de proteines issues de plasma humain lyophilisé (poudre) + WFI, pour infusion
- Reconstitution du produit en 5-10 minutes
- Demi-vie: 24 mois +2°C à +25°C
- La stabilité physico-chimique de la solution reconstituée à été démontrée pour 8 heures à temperature ambiante (max. +25°C).
- Groupe AB

RESEARCH Open Access

Impact of platelet transfusion on outcomes in trauma patients

S. R. Hamada[1*], D. Garrigue[2], H. Nougue[3], A. Meyer[4], M. Boutonnet[5], E. Meaudre[6], A. Culver[7], E. Gaertner[8], G. Audibert[9], B. Vigué[10], J. Duranteau[10], A. Godier[11] and and the TraumaBase Group

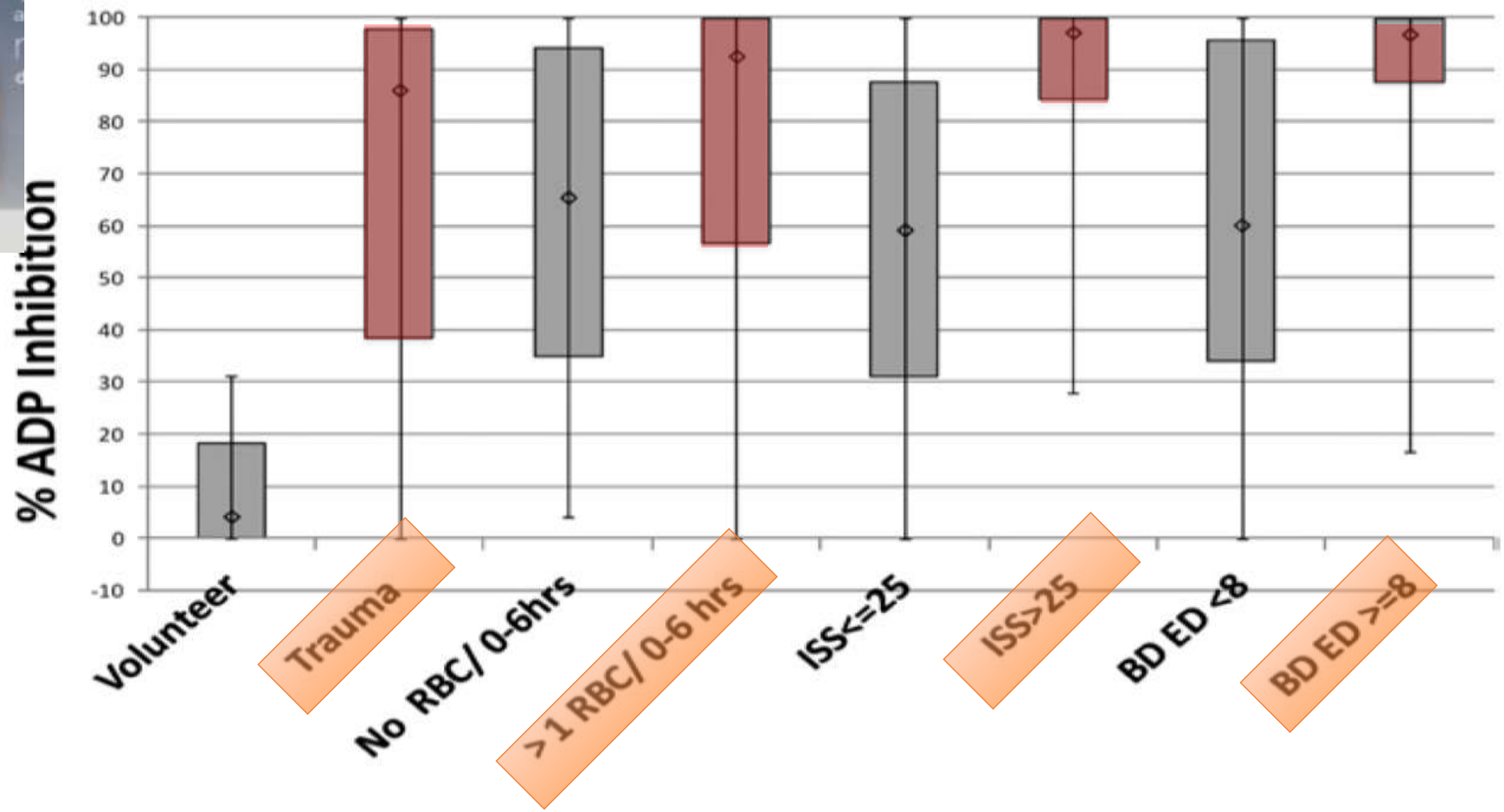




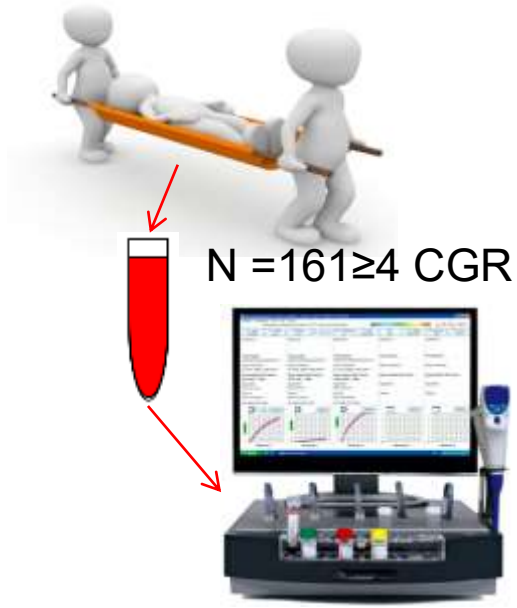
Early Platelet Dysfunction: An Unrecognized Role in the Acute Coagulopathy of Trauma

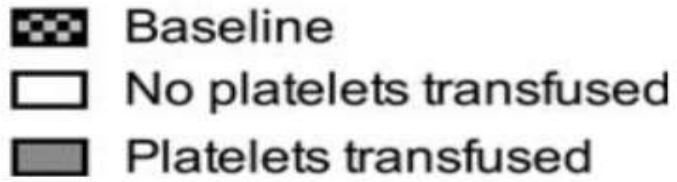
Max V Wohlauer, MD, Ernest E Moore, MD, FACS, Scott Thomas, MD, FACS, Angela Sauaia, MD, PhD, Ed Evans, BA, CCP, Jeffrey Harr, MD, MPH, Christopher C Silliman, MD, PhD, Victoria Ploplis, PhD, Francis J Castellino, PhD, Mark Walsh, MD

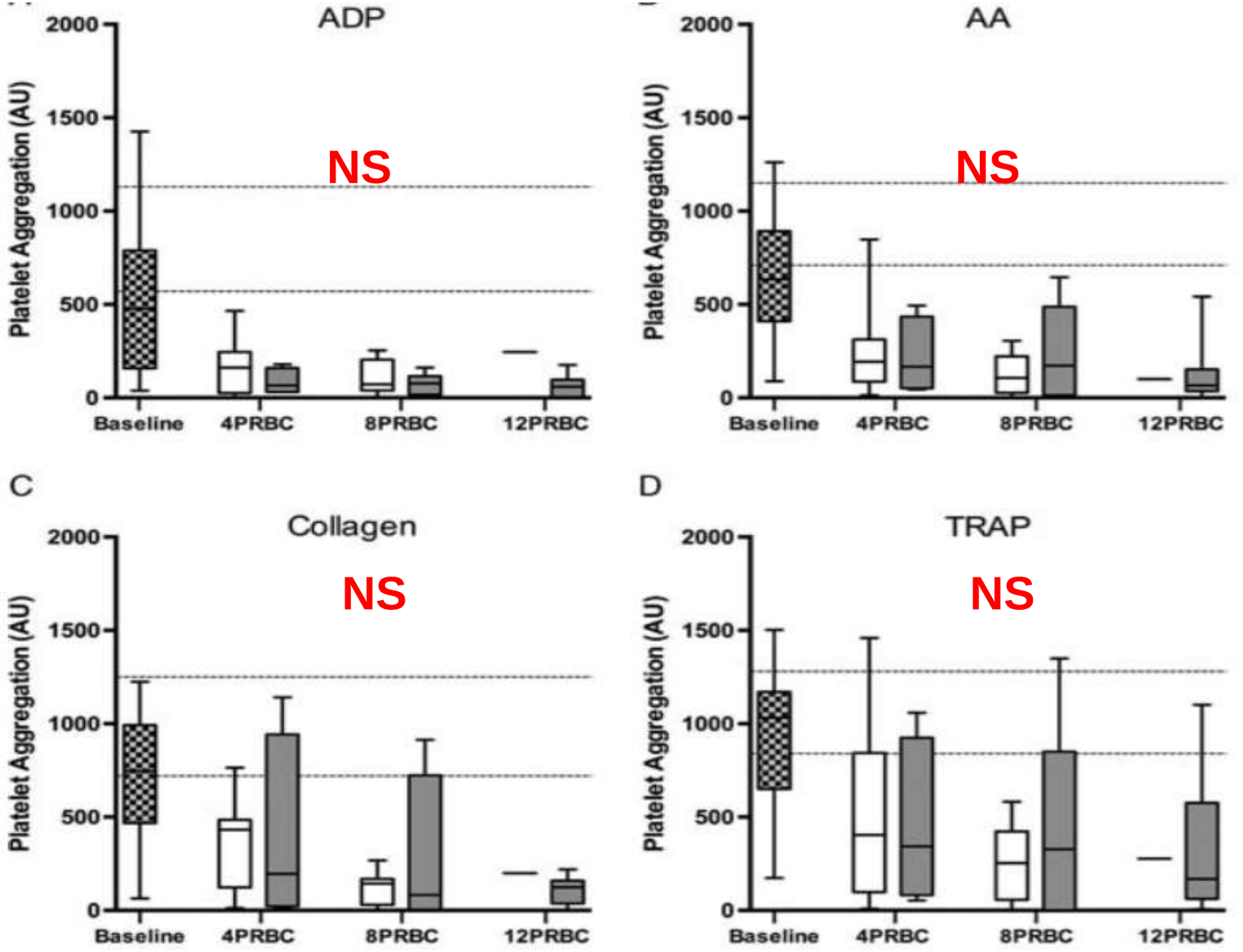
J Am Coll Surg
2012;214:739–746



Transfusion plaquettaire et dysfonction plaquettaire

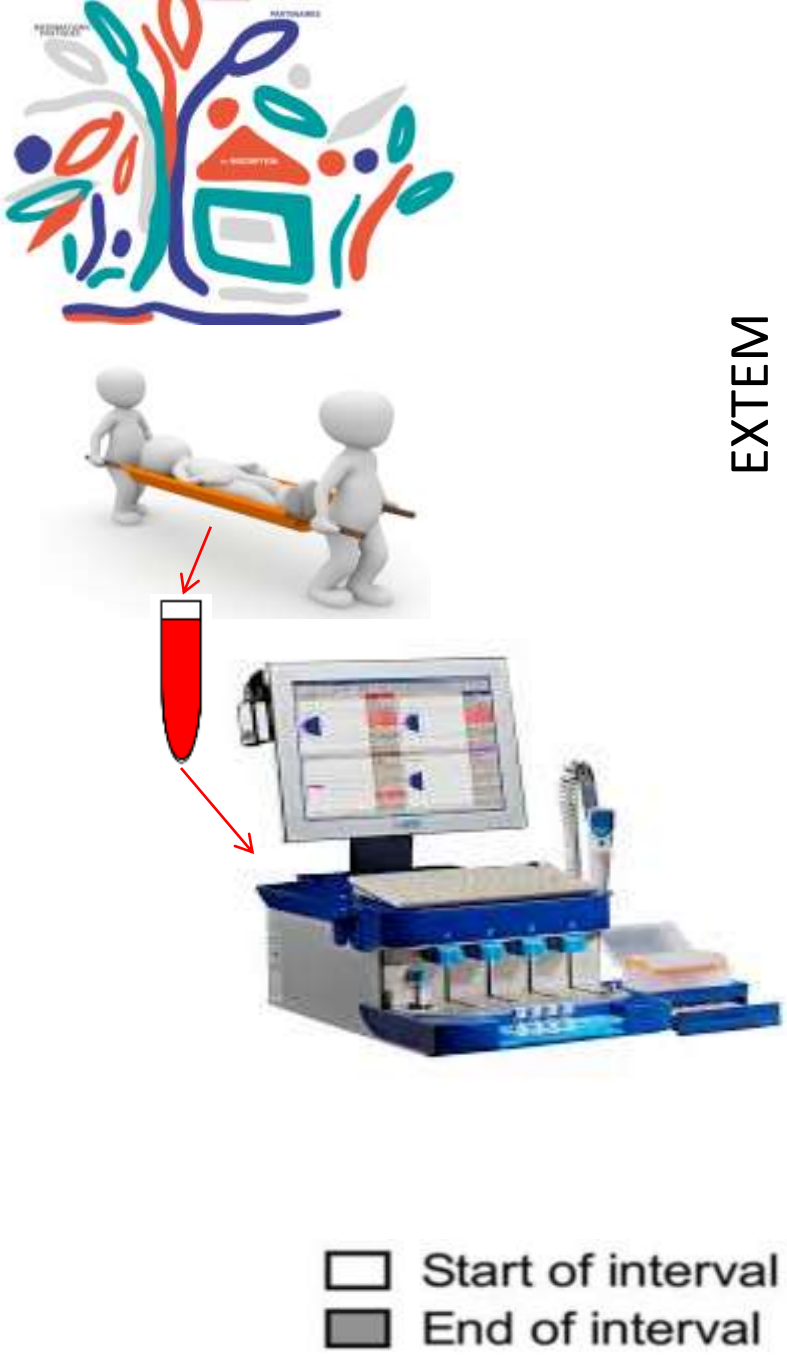


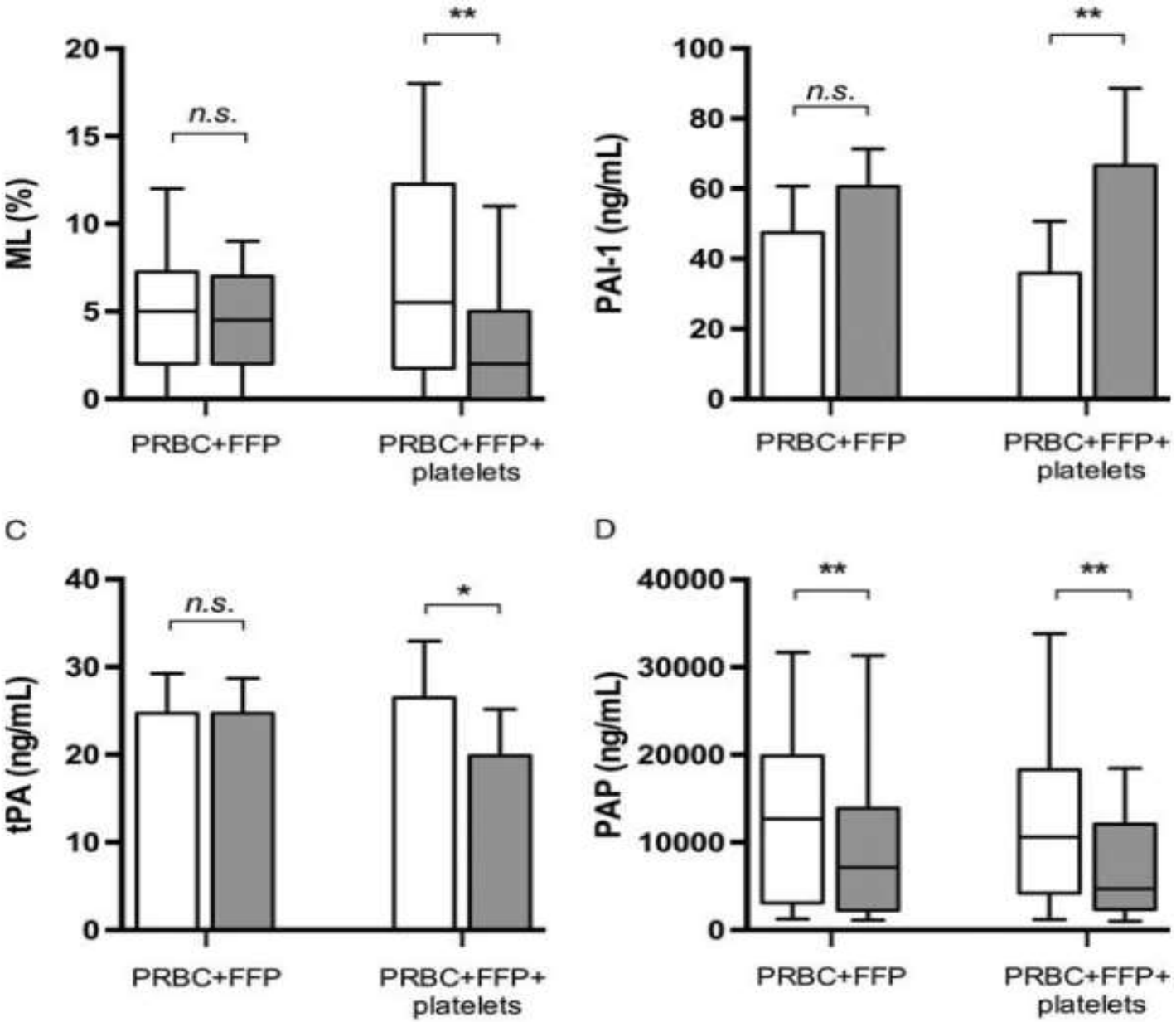




Vulliamy P et al. J Trauma Acute Care Surg. 2017 Sep;83(3):388-397.

Transfusion plaquettaire et dysfonction plaquettaire





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RESEARCH Open Access

Impact of platelet transfusion on outcomes in trauma patients

Transfusion précoce de plaquettes =
Facteur indépendant protecteur
de toutes causes de mortalité à 24 h

(OR 0,56 95% CI 0.38–0.84, p = 0.004)

Table 3 Multivariate predictors of 24-h all-cause mortality in trauma patients presenting severe haemorrhage

	Odds ratio [2.5–97.5%]
Intercept	0.86 [0.17–4.33]
Early platelet tranfusion*	0.56 [0.38–0.84]
Age*	1.02 [1.01–1.03]
Sex (m)	1.42 [0.92–2.21]
ASA 1	0.76 [0.48–1.20]
Motor GCS*	0.88 [0.79–0.99]
Mydriasis	1.24 [0.68–2.25]
Cardiac arrest*	2.10 [1.32–3.33]
Shock index	1.11 [0.78–1.58]
Norepinephrin use	1.07 [0.67–1.70]
Base Deficit*	1.09 [1.06–1.13]
Haemoglobin	1.01 [0.93–1.10]
Prothrombin time*	0.96 [0.94–0.97]
Fibrinogen*	0.56 [0.35 -0.87]
Ratio (FFP:RBC)*	0.20 [0.11–0.35]
Tranexamic acid	0.81 [0.44–1.51]
AIS head (≥ 3)*	1.67 [1.07–2.65]
ISS*	1.02 [1.01–1.03]

The logistic regression model was adjusted on well-established predictors of mortality, previously listed by a group of experts on a Delphi [17] and on confounders of early platelet transfusions identified on bivariate analysis ($p < 0.2$). Early platelet transfusion was defined as platelet transfusion within the first 6 h. Odds ratios with 95% confidence intervals [OR (95% CI)]

Conclusion

Transfusion précoce de plasma

Utile

respecter des hauts ratios (1:1:1 = sang total)

Précocité dans la première heure (pour les facteurs de coagulation)

Délai > distinction préhospitalier/intrahospitalier

Difficultés règlementaires

Difficultés organisationnelles

Coût

Transfusion précoce de plaquettes

En cas **d'hémorragie d'intensité modérée**

Futile