

# DAMAGE CONTROL MEDICAL : gestion pharmacologique et transfusionnelle du choc hémorragique

Fanny BOUNES  
CAHORS - 24 Novembre 2017



# CONFLITS D'INTÉRÊT

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Aucun.



# Recommandations sur la réanimation du choc hémorragique<sup>☆</sup>

2015

Jacques Duranteau<sup>1</sup>, Karim Asehnoune<sup>2</sup>, Sébastien Pierre<sup>3</sup>, Yves Ozier<sup>4</sup>, Marc Leone<sup>5</sup>, Jean-Yves Lefrant<sup>6</sup>, le groupe de travail de la Société française d'anesthésie et de réanimation (Sfar), de la Société de réanimation de langue française (SRLF), de la Société française de médecine d'urgence (SFMU), du Groupe d'études sur l'hémostase et la thrombose (GEHT)

Disponible sur internet le :  
2 février 2015

1. Assistance publique des Hôpitaux de Paris, hôpitaux universitaires Paris Sud, université Paris Sud XI, service d'anesthésie-réanimation, 78, rue du Général-



al. Critical Care (2016) 20:100  
/s/13054-016-1265-x



Critical Care

ARCH

Open Access



## European guideline on management of major trauma with bleeding and coagulopathy following trauma: fourth edition

aint<sup>1</sup>, Bertil Bouillon<sup>2</sup>, Vladimir Cerny<sup>3,4,5,6</sup>, Timothy J. Coats<sup>7</sup>, Jacques Duranteau<sup>8</sup>, Fernández-Mondéjar<sup>9</sup>, Daniela Filipescu<sup>10</sup>, Beverley J. Hunt<sup>11</sup>, Radko Komadina<sup>12</sup>, Giuseppe Nardi<sup>13</sup>, A. M. Neugebauer<sup>14</sup>, Yves Ozier<sup>15</sup>, Louis Riddez<sup>16</sup>, Arthur Schultz<sup>17</sup>, Jean-Louis Vincent<sup>18</sup>, et R. Spahn<sup>19\*</sup>

J Trauma2017

GUIDELINES



## Damage control resuscitation in patients with severe trauma and hemorrhage: A practice management guideline from the Eastern Association for the Surgery of Trauma

Jeremy W. Cannon, MD, SM, Mansoor A. Khan, MBBS (Lond), PhD, Ali S. Raja, MD, Mitchell J. Cohen, MD, John J. Como, MD, MPH, Bryan A. Cotton, MD, Joseph J. Dubose, MD, Erin E. Fox, PhD, Kenji Inaba, MD, Carlos J. Rodriguez, DO, John B. Holcomb, MD, and Juan C. Duchesne, MD, Philadelphia, Pennsylvania

# DAMAGE CONTROL

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# DAMAGE CONTROL

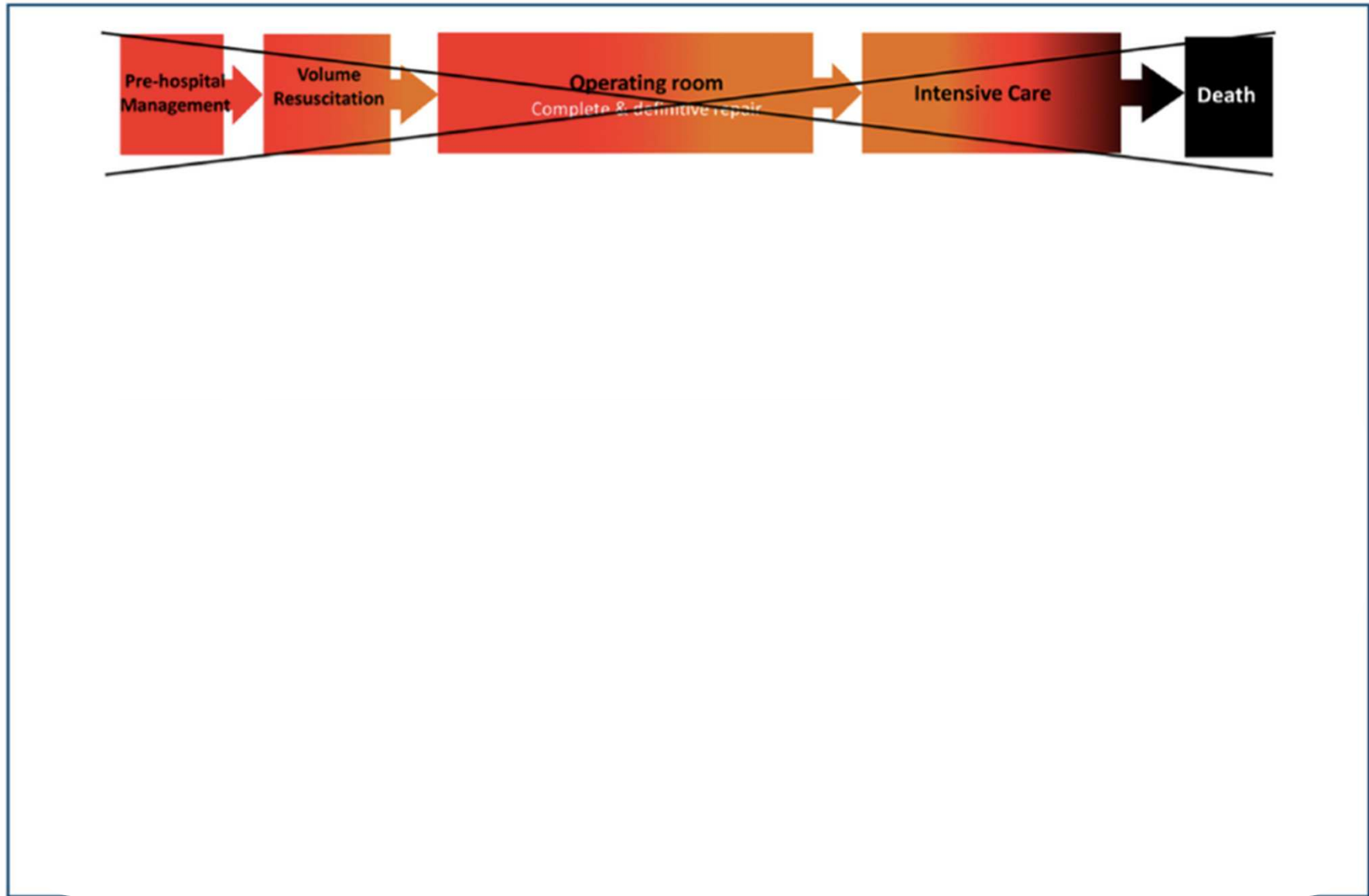
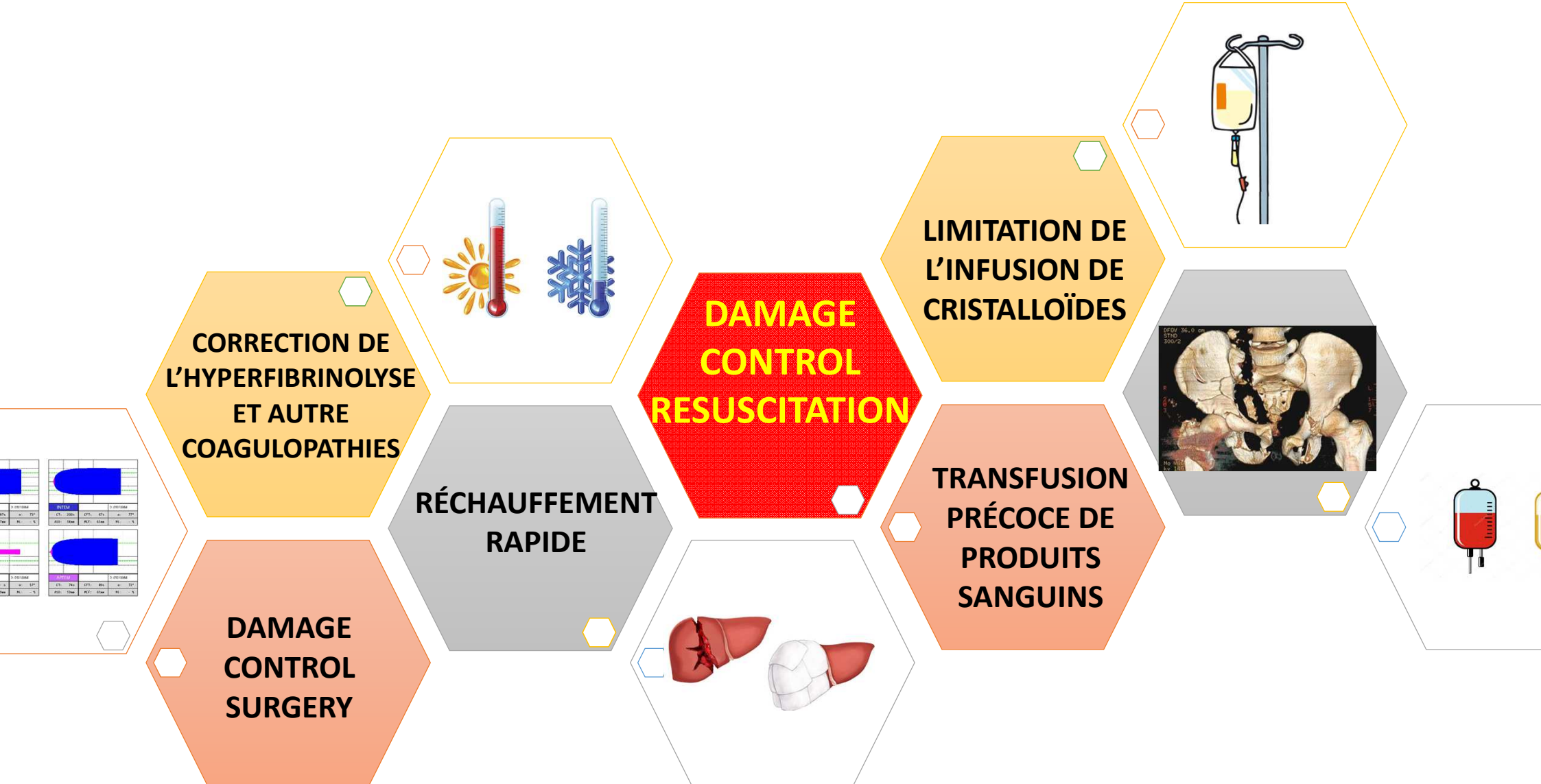


Figure 1. Evolution and extension of the concept of damage control.

# DAMAGE CONTROL



# VOS OBJECTIFS

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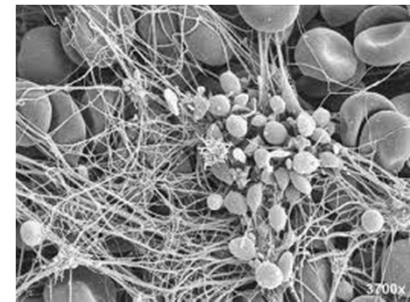
Identifier précocement **la source du saignement** et l'arrêter rapidement



Restaurer une **perfusion tissulaire adéquate**

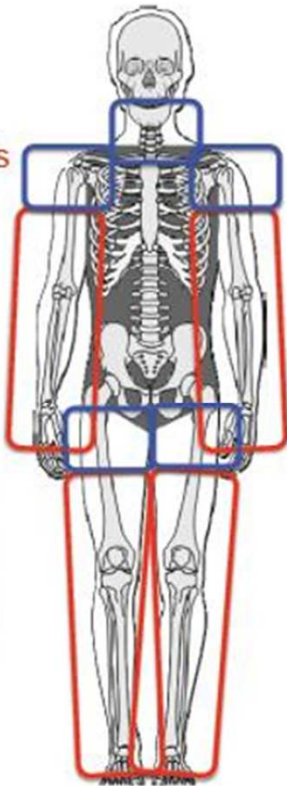


Favoriser **l'hémostase** - objectifs transfusionnels



# MOYENS MÉCANIQUES À DISPOSITION

agies des extrémités  
bles  
ssibles



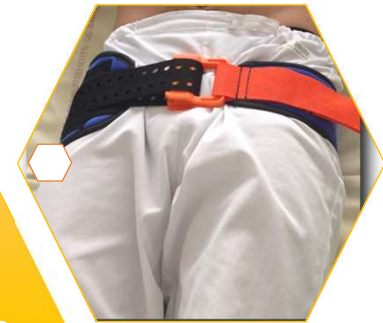
Hémorragies jonctionnelles  
Non Garrotables  
Compressibles



Garrots

Pansement  
hémostatique

Clamps,  
agrafes,  
sutures







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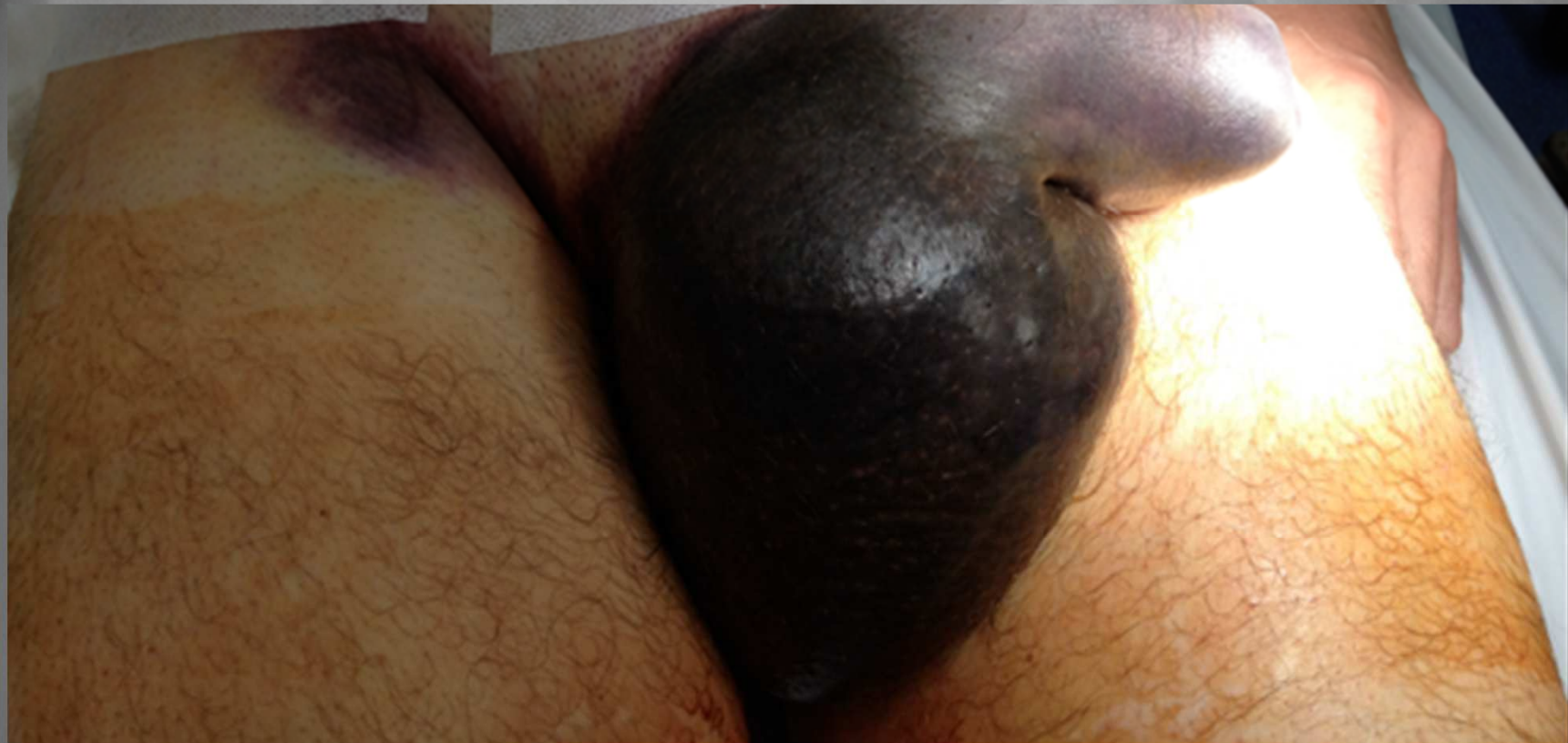
The  
American Journal of  
Emergency Medicine

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Vardon F, Brunel E et al, 2012

G

AU LIT



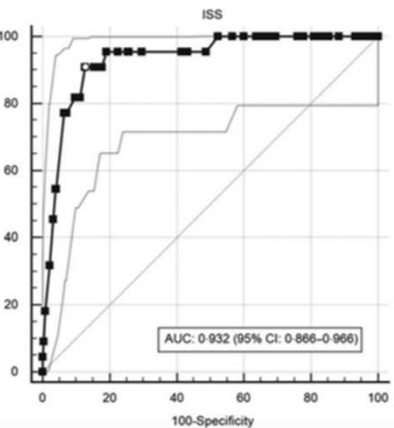
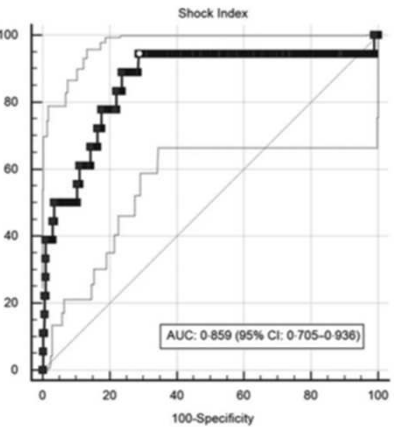
**TRANSFUSION MASSIVE ?**

# PRÉDICTION DE LA TRANSFUSION MASSIVE

Journal de Médecine Sanguinis 2017

## Prehospital parameters can help to predict coagulopathy and massive transfusion in trauma patients

S. David,<sup>1,2</sup> E.-J. Voiglio,<sup>2,3</sup> E. Cesaro,<sup>4,5</sup> O. Vassal,<sup>1,2</sup> E. Decullier,<sup>6,7</sup> P.-Y. Gueugniaud,<sup>4,5</sup> S. Peyrefitte<sup>8</sup> & Tazarourte<sup>4,5</sup>



### TASH Score (Trauma Associated Severe Hemorrhage)

Predicts the need for massive transfusion based on clinical and laboratory data.

Sex:  Male +1  Female 0

Hemoglobin:  < 7 g/dL +8  < 9 g/dL +6  < 10 g/dL +4  < 11 g/dL +3  < 12 g/dL +2  ≥ 12 g/dL 0

Base Excess:  < -10 mmol/L +4  < -6 mmol/L +3  < -2 mmol/L +1  ≥ -2 mmol/L 0

Systolic Blood Pressure:  < 100 mm Hg +4  < 120 mm Hg +1  ≥ 120 mm Hg 0

Heart Rate:  >120 bpm +2  ≤ 120 bpm 0

Positive FAST for Intra-Abdominal Fluid:  YES +3  NO 0

Clinically Unstable Pelvic Fracture:  YES +6  NO 0

Open or Dislocated Femur Fracture:  YES +3  NO 0

**27 points**  
> 85% predicted need for massive transfusion.

### ABC Score for Massive Transfusion

Determines need for massive transfusion in trauma patients.

Penetrating Mechanism?  YES  NO

ED Systolic BP ≤ 90 mmHg?  YES  NO

ED HR ≥ 120?  YES  NO

Positive Ultrasound FAST Exam?  YES  NO

**2**  
points

Likely to require massive transfusion (10 units or more of PRBCs).

In the ABC Score studies, scores 2 or more were likely to require massive transfusion (10 units or more of PRBCs), with sensitivity and specificity ranging from 75% to 90% and 67% to 88%, respectively at multiple trauma centers.

## RÔLE DU RÉGULATEUR ANTICIPATION +++



# INTÉRÊT DU PACK TRANSFUSIONNEL ?

best “formula” to follow. The “best guess” policy usually comprises a specified ratio of RBC, FFP and other treatments, given in “bundles” or “packs”. During further re-

Rossaint R, *Crit Care* 2016

tration et la procédure de délivrance rapide. Les produits sanguins peuvent être distribués conjointement, en « packs hémostatiques », au sein desquels figure la notion de ratio entre CGR, plasma et plaquettes. Ces packs incluent un nombre prédéfini de CGR, de plasma et de plaquettes, à transfuser simultanément et de façon répétée jusqu'à stabilisation du patient. Si on ne dispose pas de résultats immunohématologi-

## Recommandation

Il est recommandé qu'une procédure locale de gestion de l'hémorragie massive soit élaborée dans chaque structure médico-chirurgicale avec une approche multidisciplinaire (GRADE 1+).

RFE SFAR 2015

verely injured bleeding trauma patients. Preparing MT packs or pre-positioning blood products in the trauma resuscitation bay in a 1:1:1 ratio (e.g., 6 units PLAS, 1 unit apheresis PLT, and 6 units RBC) can help avoid a significant ratio imbalance during the early empiric resuscitation phase. Additionally, leading with

Cotton, *J Trauma* 2017

# HYPOTENSION PERMISSIVE & LIMITATION DU VOLUME DE CRISTALLOÏDES

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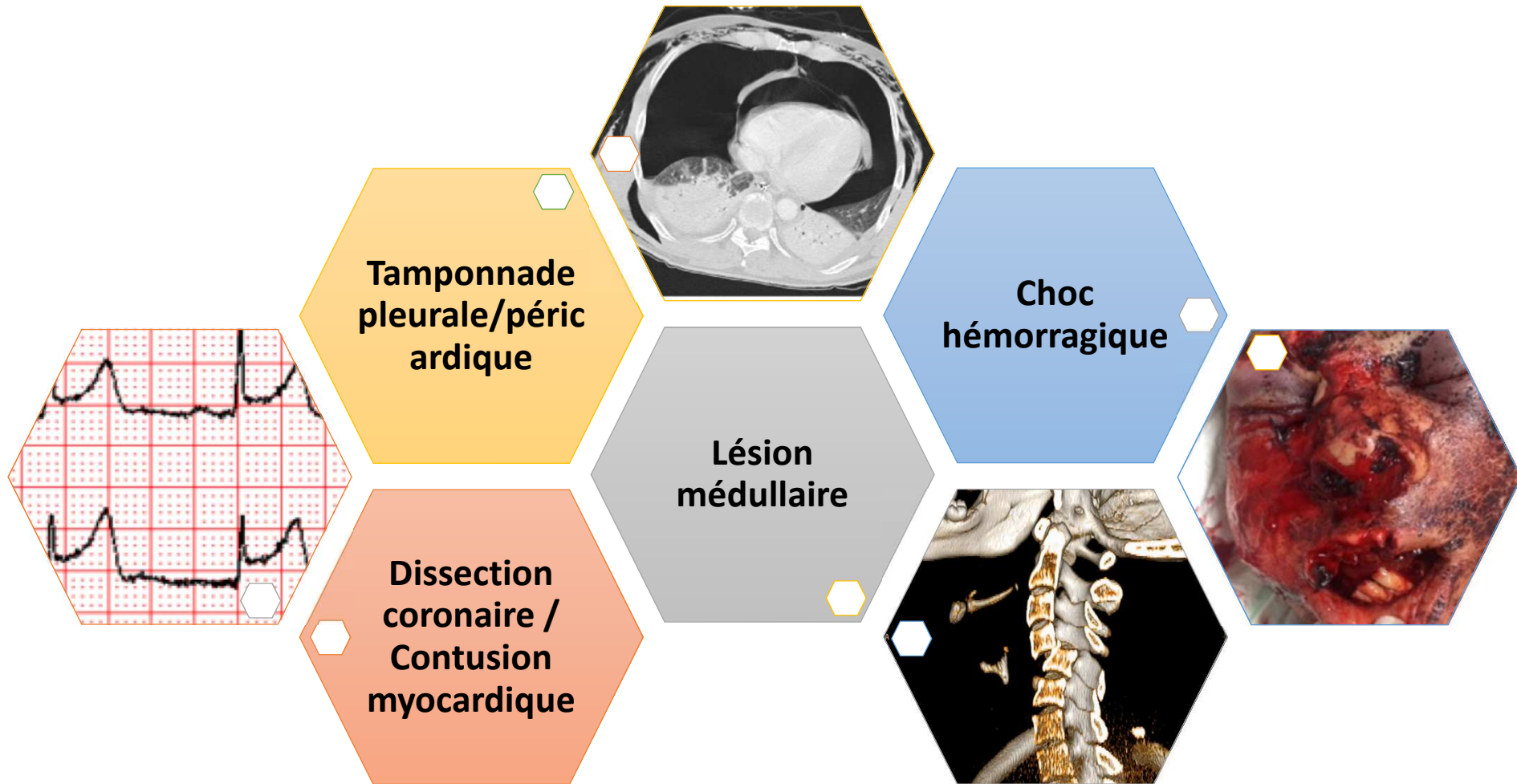
**Recommendation 13** We recommend a target systolic blood pressure of 80–90 mmHg until major bleeding has been stopped in the initial phase following trauma without brain injury. (Grade 1C)

In patients with severe TBI (GCS  $\leq 8$ ), we recommend that a mean arterial pressure  $\geq 80$  mmHg be maintained. (Grade 1C)

=> Limiter le volume de saignement jusqu'à l'hémostase chirurgicale/interventionnelle



# INSTABILITÉ HÉMODYNAMIQUE



# HYPOTENSION PERMISSIVE & LIMITATION DU VOLUME DE CRISTALLOÏDES

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=> Limiter le volume de saignement jusqu'à l'hémostase chirurgicale/interventionnelle

***Restricted volume replacement***

***Recommendation 14*** We recommend use of a restricted volume replacement strategy to achieve target blood pressure until bleeding can be controlled. (Grade 1B)

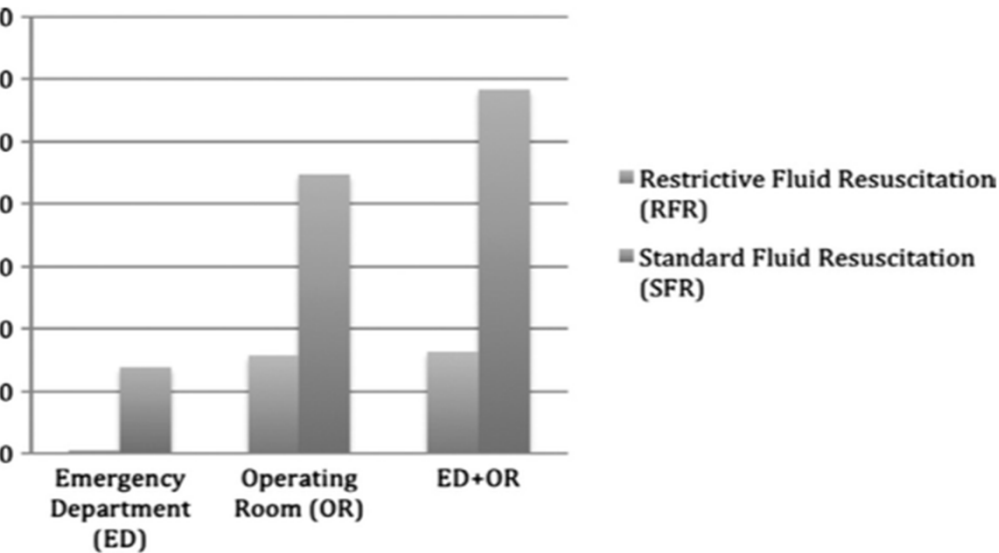
=> Limiter la dilution des facteurs de coagulation, l'acidose hyperchlorémique, l'hypothermie...

# LIMITATION DU VOLUME DE REMPLISSAGE

## Restrictive fluid resuscitation in combination with damage control resuscitation: Time for adaptation

Quinn D. Duke, MD, Chrissy Guidry, DO, Jordan Guice, Lance Stuke, MD, MPH, Alan B. Marr, MD, John P. Hunt, MD, MPH, Peter Meade, MD, MPH, Norman E. McSwain, Jr., MD, and Juan Carlos Duchesne, MD, *New Orleans, Louisiana*

J Trauma, 2012



**TABLE 3.** Logistic Regression for Mortality

Variables	Odds Ratio (95% CI)
RFR	0.69 (0.37–0.91)
ISS	1.02 (0.99–1.06)
SBP	0.99 (0.98–1.01)
Male sex	1.64 (0.29–9.17)



# LIMITATION DU VOLUME DE REMPLISSAGE

## The Association Between Fluid Administration and Outcome Following Major Burn

### A Multicenter Study

Matthew B. Klein, MD,\* Douglas Hayden, MS,† Constance Elson, PhD,‡  
 Avery B. Nathens, MD, PhD, MPH,‡ Richard L. Gamelli, MD,§ Nicole S. Gibran, MD,\*  
 David N. Herndon, MD,|| Brett Arnoldo, MD,¶ Geoff Silver, MD,‡ David Schoenfeld, PhD,‡  
 and Ronald G. Tompkins, MD, ScD#

Ann Surg, 2007

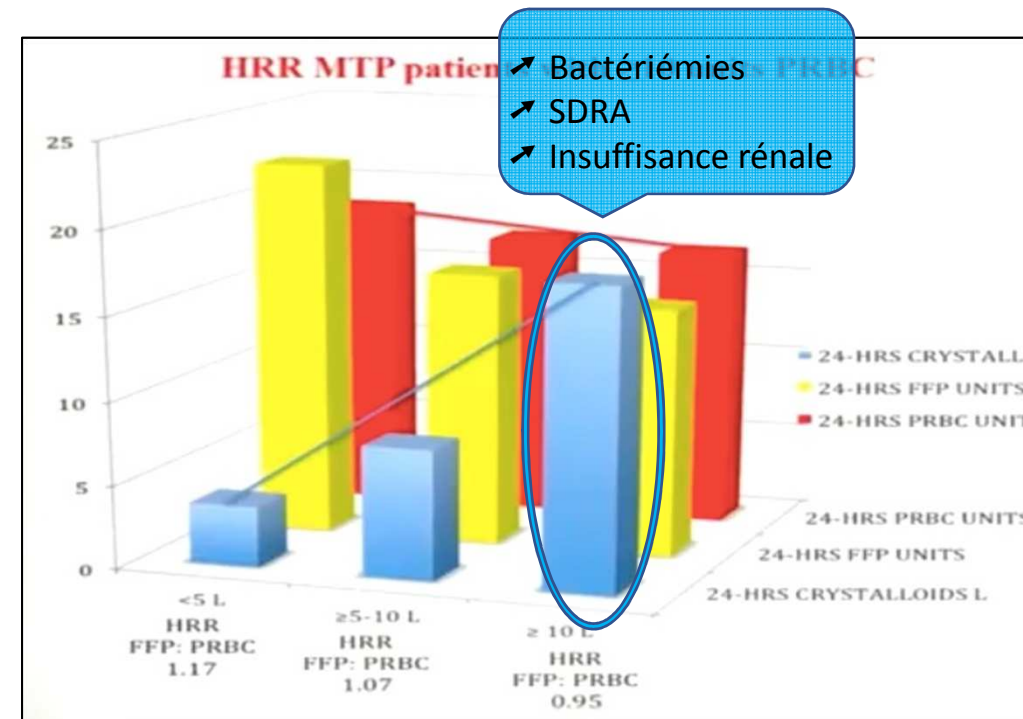
72 patients, remplissage massif =>

- pneumopathies (OR=1,92), ➤ bactériémies (OR=2,2),
- SDRA (OR=1,55), ➤ SDMV (OR=1,49),
- décès (OR=1,74).

## Diluting the benefits of hemostatic resuscitation: A multi-institutional analysis

Carlos Duchesne, MD, Jiselle Heaney, MD, MPH, Chrissy Guidry, MD, DO, Norman McSwain, Jr. MD,  
 Wade, MD, MPH, Mitchell Cohen, MD, Martin Schreiber, MD, Kenji Inaba, MD, Dimitra Skiada, MD,  
 Demetrius Demetriades, MD, PhD, John Holcomb, MD, Charles Wade, PhD,  
 and Bryan Cotton, MD, MPH, New Orleans, Louisiana

uma center niveau I, transfusions massives, hauts ratio  
**IMPACT DU VOLUME DE CRISTALLOÏDES**



# QUELQUES RÉSERVES...

RESEARCH

Open Access

European guideline on management of  
trauma-related bleeding and coagulopathy  
in severe trauma: fourth edition



Journal of Intensive Care Medicine, Crit Care 2016



It should be noted that a damage control resuscitation strategy using restrictive volume replacement is contraindicated in patients with TBI and spinal injuries, because an adequate perfusion pressure is crucial to ensure tissue oxygenation of the injured central nervous system [229]. Rapid bleeding control is of particular importance

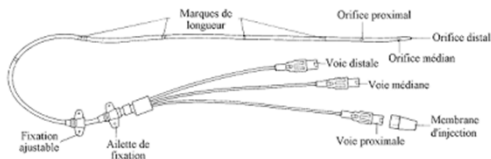


in these patients. In addition, the concept of permissive hypotension should be carefully considered in the elderly patient, and may be contraindicated if the patient suffers from chronic arterial hypertension [230].

# RAPPEL...



Code couleur	Gauge (G)	Longueur mm	Débit maxi ml/mn
Orange	14 G	45	
Gris	16 G	45	
Vert	18 G	30 45	
Rose	20 G	30 48	
Bleu	22 G	25	
Jaune	24 G	19	



**Alors que sur une VVC..**

14G, 150 mm => 68 ml/min

14G, 200 mm => 65 ml/min

# NORADRÉNALINE

*pressors and inotropic agents*

**Recommendation 15** In the presence of life-threatening hypotension, we recommend administration of vasopressors in addition to fluids to maintain mean arterial pressure. (Grade 1C)

Rossaint R, *Crit Care* 2016

## Recommendation

Après avoir débuté un remplissage vasculaire, il faut immédiatement administrer un vasopresseur en cas de persistance de l'hypotension artérielle (PAS < 80 mmHg) (GRADE 2+).

## Recommendation

Il est probablement recommandé d'administrer la noradrénaline en première intention (GRADE 2+).

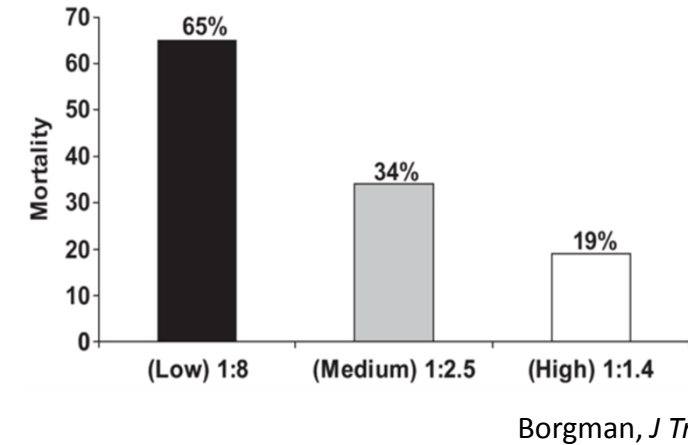
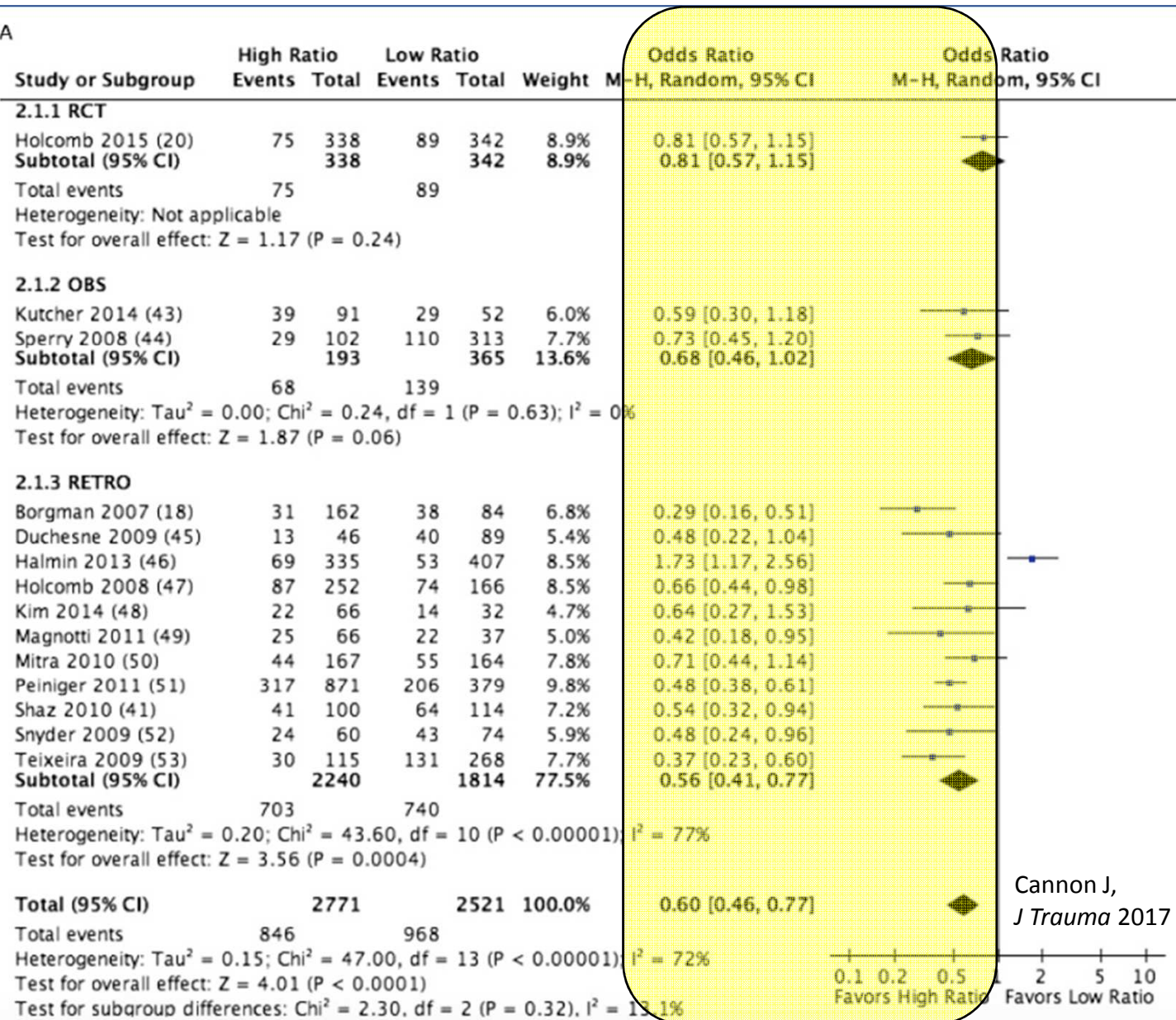
## Recommendation

Il est recommandé que la pose d'un cathéter veineux central ne retarde pas le traitement étiologique et la stabilisation hémodynamique (remplissage vasculaire et vasopresseur) de l'état de choc si des voies veineuses périphériques sont disponibles rapidement (GRADE 1+).

L'administration de noradrénaline est recommandée sur une voie veineuse centrale. Cependant, dans un contexte d'urgence, et dans l'attente de la pose d'un accès central, il est recommandé d'utiliser une voie périphérique (GRADE 1+).

**Anticiper avant l'induction du patient +++**

# RATIO CGR/PFC



## Initial coagulation resuscitation

**Recommendation 24** In the initial management of patients with expected massive haemorrhage, we recommend one of the two following strategies:

- Plasma (FFP or pathogen-inactivated plasma) to maintain a plasma-RBC ratio of at least 1:2 as needed. (GRADE 1B)

Rossaint, Crit Care

## Recommendation

Il faut probablement transfuser le plasma frais congelé en association avec les CGR avec un ratio PFC:CGR compris entre 2 et 1/1 (GRADE 2+).

# PLASMA FRAIS CONGELÉS : JUSTE CE QU'IL FAUT

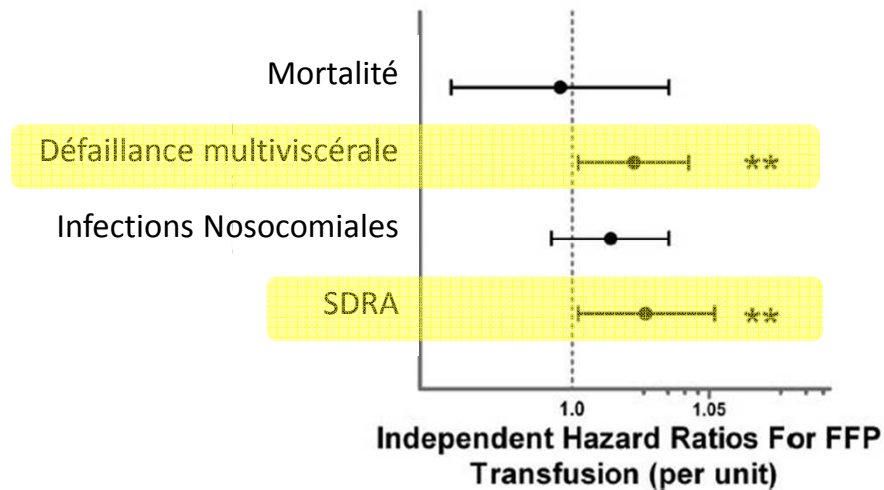


Figure 1. Independent outcome risks attributable to FFP transfusion (per unit).

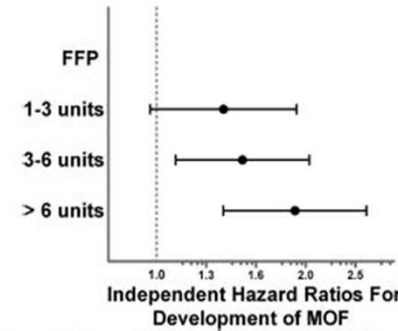


Figure 3. Independent MOF risk attributable to FFP transfusion (categorized by quartiles).

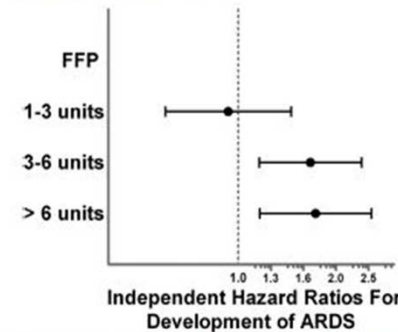


Figure 4. Independent ARDS risk attributable to FFP transfusion (categorized by quartiles).

Risque de SDRA, SDMV

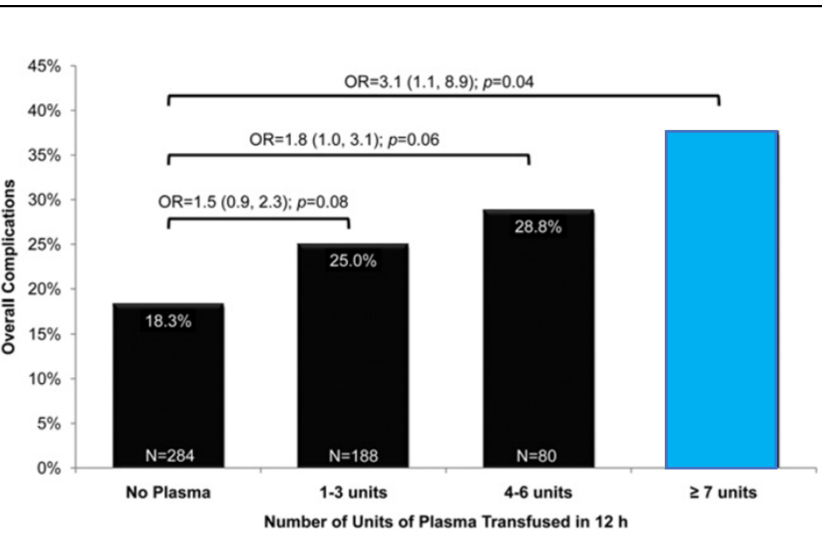
# PLASMA FRAIS CONGELÉS : JUSTE CE QU'IL FAUT

## Effect of Plasma Transfusion in Trauma Patients Do Not Require Massive Transfusion

..., MD, FRCSC, FACS, Bernardino C Branco, MD, Peter Rhee, MD, FACS,  
 Mackbourne, MD, FACS, John B Holcomb, MD, FACS, Pedro GR Teixeira, MD, Ira Shulman, MD,  
 ..., MD, Demetrios Demetriades, MD, PhD, FACS  
*J Am Coll Surg, 2010*

patients traumatisés ayant reçu une transfusion massive.

### Taux global de complications



### ARDS

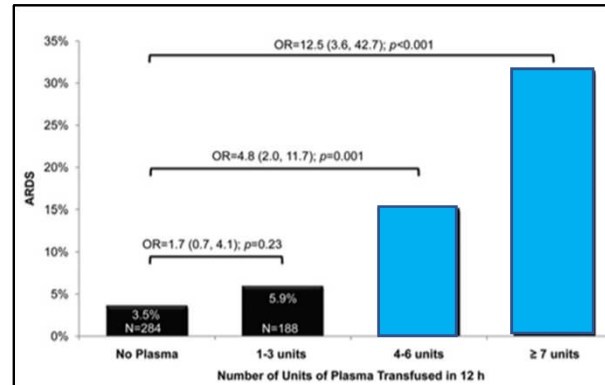


Figure 3. ARDS rates stratified by the number of units of plasma transfused in 12 hours. OR, odds ratio (95% confidence interval); p-values were derived from McNemar's chi-square test.

### MOF

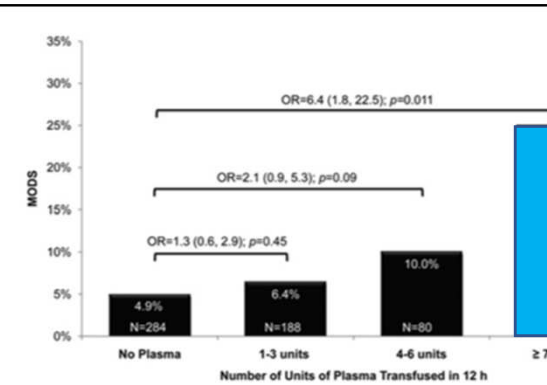


Figure 4. Multiple organ dysfunction syndrome rates stratified by the number of units of plasma transfused in 12 hours. OR, odds ratio (95% confidence interval); p-values were derived from McNemar's chi-square test.

### Pneumopathie

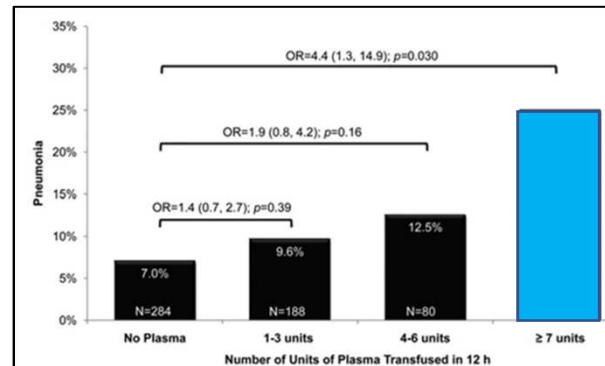


Figure 5. Pneumonia rates stratified by the number of units of plasma transfused in 12 hours. OR, odds ratio (95% confidence interval); p-values were derived from McNemar's chi-square test.

### Sepsis

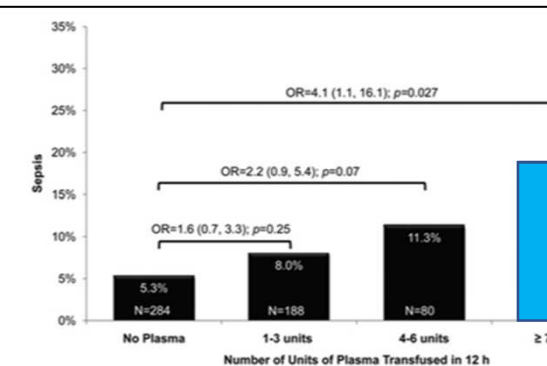


Figure 6. Sepsis rates stratified by the number of units of plasma transfused in 12 hours. OR, odds ratio (95% confidence interval); p-values were derived from McNemar's chi-square test.

# RATIO CGR/PLAQUETTES

## Recommandation

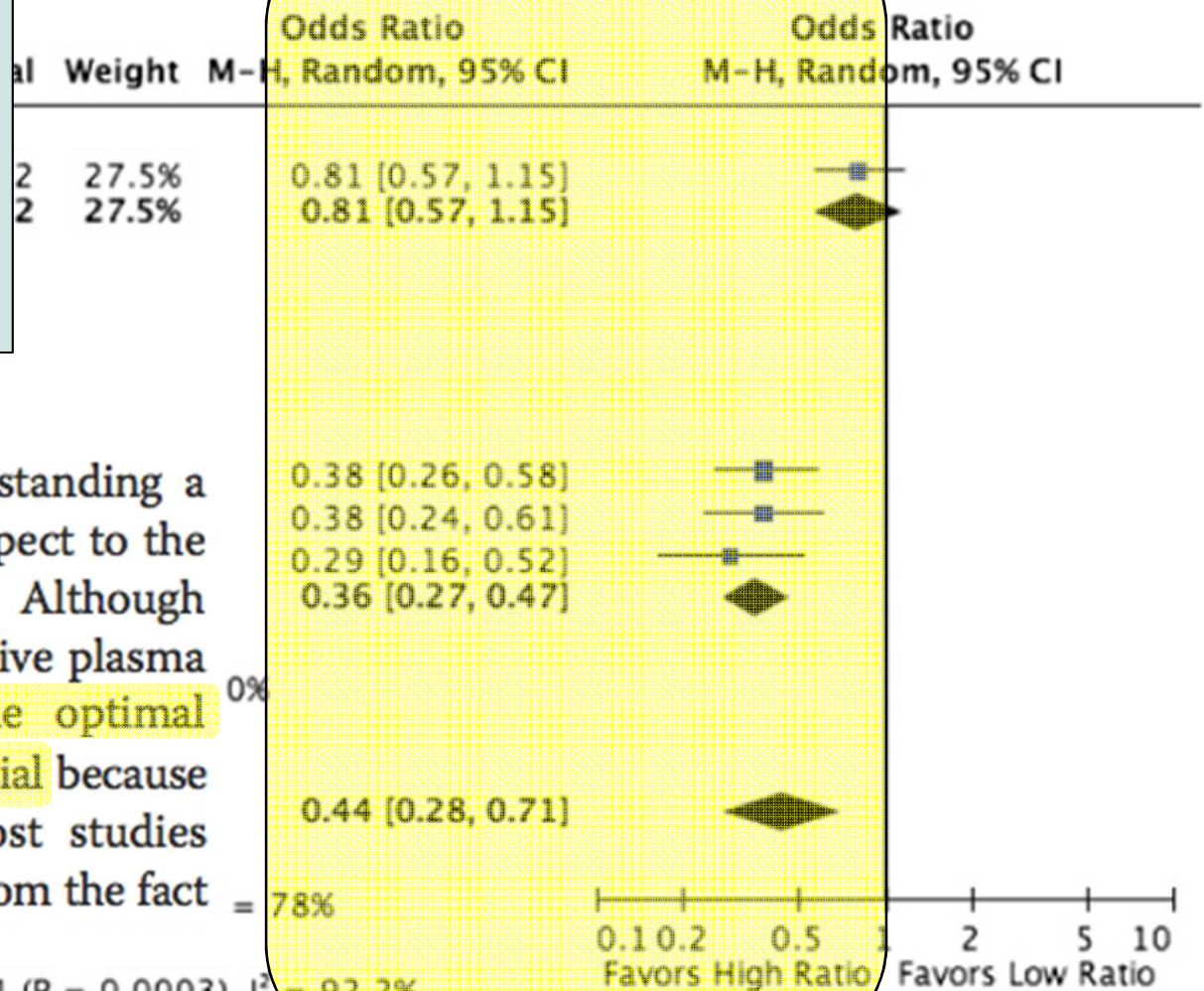
Il est recommandé de mettre en œuvre une transfusion plaquettaire précoce, généralement lors de la deuxième prescription transfusionnelle, pour maintenir la numération des plaquettes au-dessus de 50 G/L (GRADE 1+). Ce chiffre doit probablement être porté à 100 G/L en cas de traumatisme crânien associé ou de persistance du saignement (GRADE 2+).

### 3.1.3 RETRO

... were able to improve survival. Notwithstanding a large number of studies, the evidence with respect to the use of high ratios shows conflicting results. Although many authors suggested that early and aggressive plasma transfusion may reduce mortality [393], the optimal P:RBC and platelet:RBC ratio was controversial because of the possible survival bias that flaws most studies [394, 395]. Survival bias is the bias resulting from the fact

Test for overall effect:  $Z = 3.41$  ( $P = 0.0006$ )

Test for subgroup differences:  $\text{Chi}^2 = 12.81$ ,  $\text{df} = 1$  ( $P = 0.0003$ ),  $I^2 = 92.2\%$





# RATIO CGR/PLAQUETTES

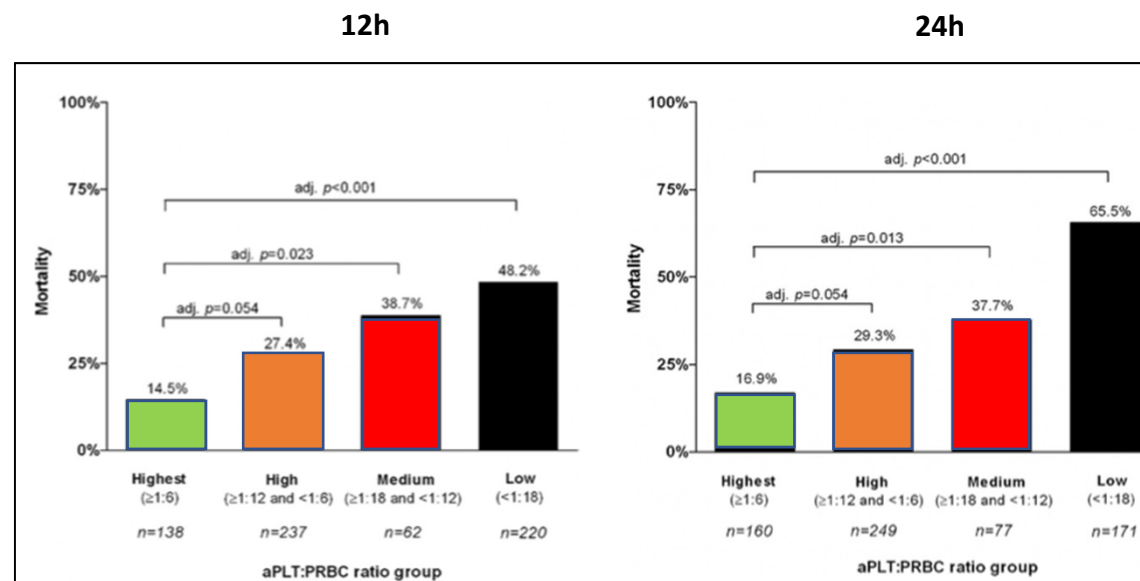
## ORIGINAL SCIENTIFIC ARTICLES

### The Impact of Platelet Transfusion in Massively Transfused Trauma Patients

Kenji Inaba, MD, FACS, Thomas Lustenberger, MD, Peter Rhee, MD, FACS, John B Holcomb, MD, FACS, Torne H Blackbourne, MD, FACS, Ira Shulman, MD, Janice Nelson, MD, Peep Talving, MD, FACS, Demetrios Demetriades, MD, FACS

*J Am Coll Surg, 2010*

657 patients traumatisés ayant reçu une transfusion massive



**Table 4.** Predictors of Mortality at 24 Hours

Step	Variable	Adjusted odds ratio (95% CI)	Adjusted p value	R <sup>2</sup>
1	FFP:PRBC ratio (%) at 24 h*	0.96 (0.95–0.97)	<0.001	0.269
2	GCS ≤ 8	6.57 (3.98–10.86)	<0.001	0.167
3	PRBC units within 24 h	1.06 (1.04–1.08)	<0.001	0.041
4	aPLT:PRBC ratio (%) at 24 h†	0.92 (0.89–0.95)	<0.001	0.035
5	SBP < 90 mmHg	2.42 (1.49–3.95)	<0.001	0.016
6	ISS ≥ 25	2.05 (1.27–3.32)	0.003	0.012

# PLYO

En évaluation pré et intra-hospitalière

Apport de la médecine de guerre

Plasma « AB-like », compatible avec tous les groupes sanguins

Stockage 2 ans t°C ambiante

Reconstitution en moins de 6 minutes.



**ClinicalTrials.gov** Find Studies About Studies Submit Studies Resources About Site

Home > Study Record Detail  Save this study Saved Studies (0)

**Pre-hospital Administration of Lyophilized Plasma for Post-traumatic Coagulopathy Treatment (PREHO-PLYO) (PREHO-PLYO)**

**This study is currently recruiting participants.**

[See ► Contacts and Locations](#)

*Verified April 2017 by Daniel Jost, Fire Brigade Of Paris Emergency Medicine Dept*

**Sponsor:**  
French Defence Health Service

**ClinicalTrials.gov Identifier:**  
NCT02736812

First Posted: April 13, 2016  
Last Update Posted: April 21, 2017

**Freeze-dried Plasma in the Initial Management of Coagulopathy in Trauma Patients (TrauCC)**

**This study has been completed.**

**Sponsor:**  
University Hospital, Lille

**ClinicalTrials.gov Identifier:**  
NCT02750150

First Posted: April 25, 2016  
Last Update Posted: April 25, 2016

# FIBRINOGENÈ



## DIMINUTION DES FACTEURS DE L'HÉMOSTASE AU COURS DES HÉMORRAGIES MASSIVES (CG +COLLOÏDES)

Facteur	Taux critique	Perte sanguine (% )*
Plaquettes	$50 \times 10^9/L$	230 (169-294)=2 masses
<b>Fibrinogène</b>	<b>1.0 g/L</b>	<b>142 (117-169)=1 masse sanguine</b>
Prothrombine	20%	201 (160-244)=2 masses
Facteur V	25%	229 (167-300)=2 masses
Facteur VII	20%	236 (198-277)=2 masses

\*du volume sanguin total calculé

Hiippala ST et al, *Anesth Ana*

**1<sup>er</sup> facteur à atteindre un taux critique dans l'hémorragie massive**

# FIBRINOÈNE

## Fibrinogen and cryoprecipitate

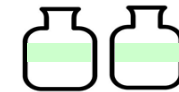
**Recommendation 28** If a concentrate-based strategy is used, we recommend treatment with fibrinogen concentrate or cryoprecipitate if significant bleeding is accompanied by viscoelastic signs of a functional fibrinogen deficit or a plasma fibrinogen level of less than 1.5–2.0 g/l. (Grade 1C)

We suggest an initial fibrinogen supplementation of 3–4 g. This is equivalent to 15–20 single donor units of cryoprecipitate or 3–4 g fibrinogen concentrate. Repeat doses must be guided by viscoelastic monitoring and laboratory assessment of fibrinogen levels. (Grade 2C)

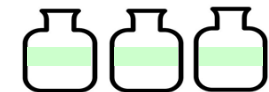
Rossaint R, *Crit Care* 2016



< 80 kg : 3 g

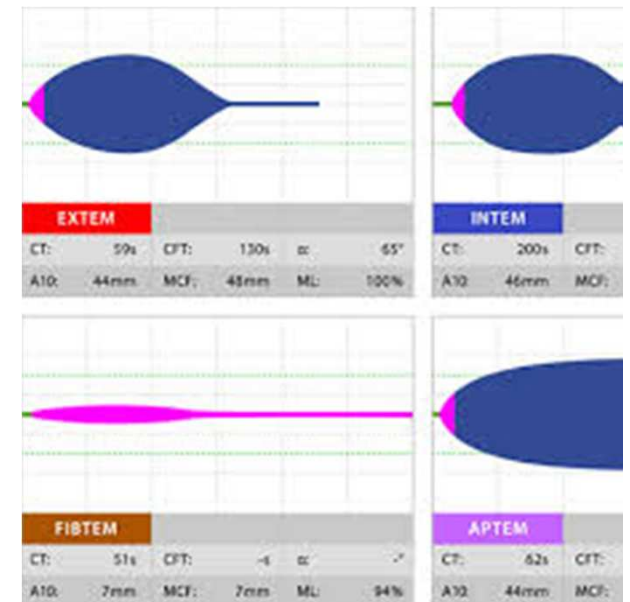


> 80 kg : 4,5 g



## Recommandation

L'administration de concentrés de fibrinogène est probablement recommandée en cas de fibrinogénémie  $\leq 1,5$  g/L (GRADE 2+), ou de paramètres thromboélastographiques (-métriques) de déficit en fibrinogène fonctionnel (GRADE 2+). Une dose initiale de 3 g est suggérée chez un adulte de 70 kg.



# ACIDE TRANEXAMIQUE

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## Recommandation FORTE

Acide tranexamique **DANS LES 3 HEURES**  
Lutte contre la lyse du caillot de fibrine.

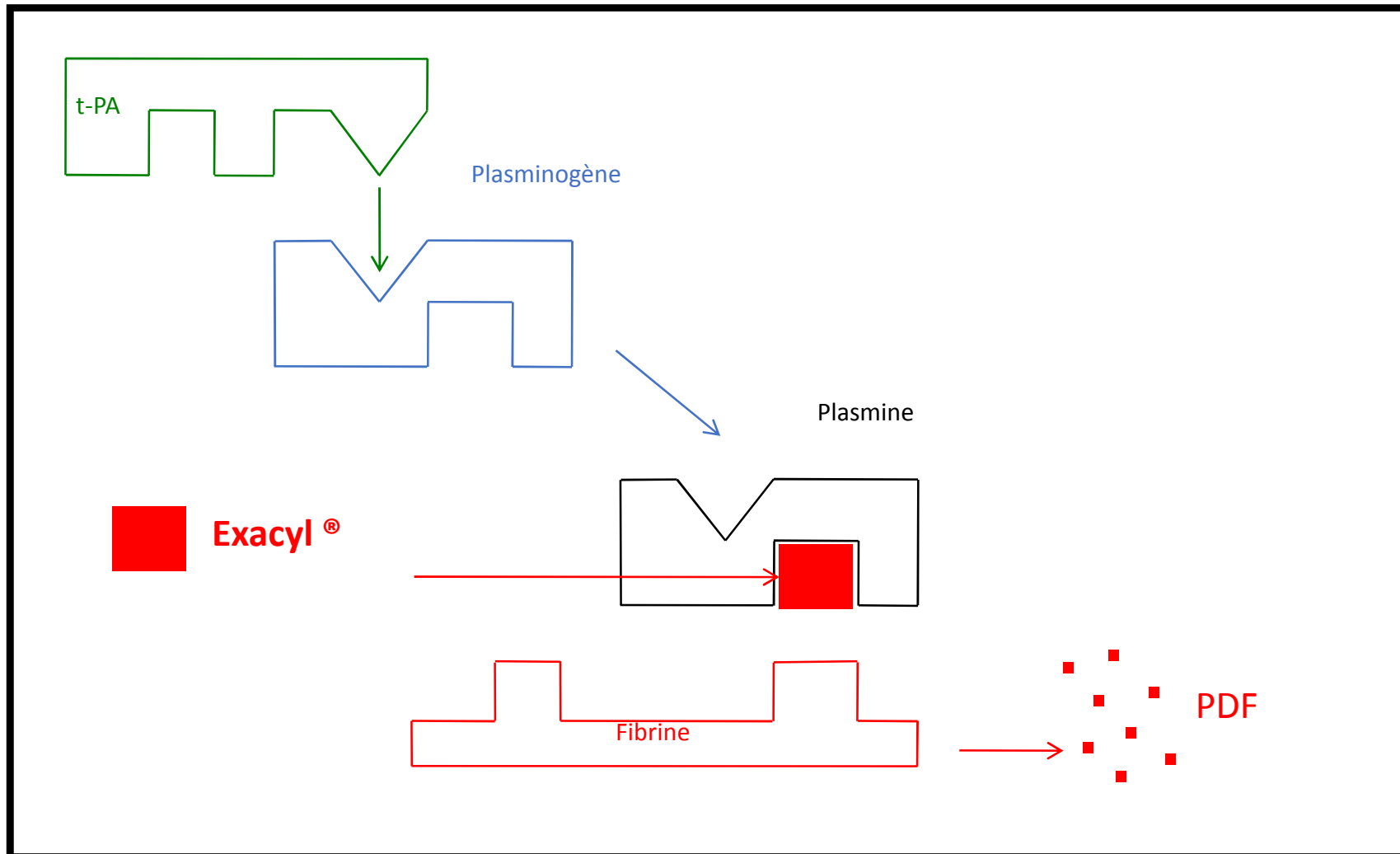
**1g ds 100 ml NaCl iso en 10' puis 1g/8h IVSE.**

**Administration pré-hospitalière LE PLUS TÔT POSSIBLE !**

Etude CRASH 2, 2010 Lancet

40 pays, > 20 000 victimes. Baisse significative de la mortalité de 14 %.

# ACIDE TRANEXAMIQUE : MODE D'ACTION



# CCP – AVK/NACO

## Recommandation

En cas de choc hémorragique survenant chez un patient traité par AVK, il est recommandé d'administrer sans délai des concentrés de complexe prothrombinique (CCP, encore dénommés PPSB) à la dose de 25 U/kg ou adaptée à l'INR, associés à 10 mg de vit K. (GRADE 1 +).

## Recommandation

En cas de choc hémorragique survenant chez un patient traité par anticoagulants oraux directs (dabigatran, rivaroxaban, apixaban) (AOD), il faut probablement tenter une neutralisation immédiate de l'effet anticoagulant de l'AOD par, soit du FEIBA 30–50 U/kg, soit des CCP 50 U/kg, éventuellement renouvelés 1 fois à 8 h d'intervalle (GRADE 2 +).

### *Direct oral anticoagulants – factor Xa inhibitors*

**Recommendation 34** We suggest the measurement of plasma levels of oral anti-factor Xa agents such as rivaroxaban, apixaban or edoxaban in patients treated or suspected of being treated with one of these agents. (Grade 2C)

If measurement is not possible or available, we suggest that advice from an expert haematologist be sought. (Grade 2C)

If bleeding is life-threatening, we suggest treatment with TXA 15 mg/kg (or 1 g) intravenously and high-dose (25–50 U/kg) PCC/aPCC until specific antidotes are available. (Grade 2C)

### *Direct oral anticoagulants – thrombin inhibitors*

**Recommendation 35** We suggest the measurement of dabigatran plasma levels in patients treated or suspected of being treated with dabigatran. (Grade 2C)

If measurement is not possible or available, we suggest thrombin time and APTT to allow a qualitative estimation of the presence of dabigatran. (Grade 2C)

If bleeding is life-threatening, we recommend treatment with idarucizumab (5 g intravenously) (Grade 1B), or, if unavailable, we suggest treatment with high-dose (25–50 U/kg) PCC/aPCC, in both cases combined with TXA 15 mg/kg (or 1 g) intravenously. (Grade 2C)

# MAIS AUSSI



## Sources de refroidissement

### PRÉ-HOSPITALIER

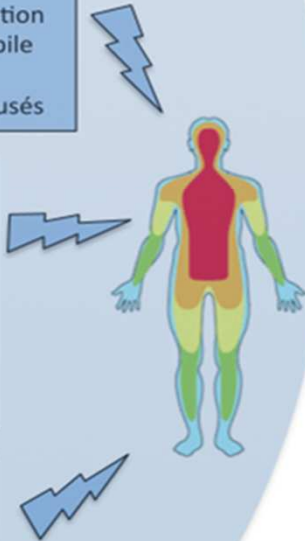
- ✓ Environnement
- ✓ Saison hivernale
- ✓ Durée de désincarcération
- ✓ Sévérité du traumatisme
- ✓ Patient dénudé
- ✓ Traumatisme crânien
- ✓ Pression artérielle systolique < 100mmHg
- ✓ Intubation, anesthésie-sédation
- ✓ Température de l'Unité Mobile Hospitalière
- ✓ Température des fluides infusés

### ADMISSION

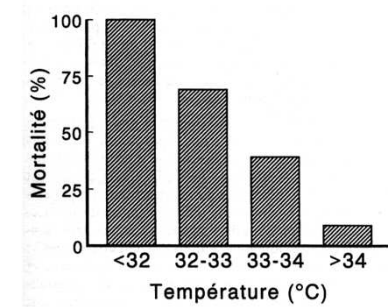
- ✓ Environnement
- ✓ Patient dénudé
- ✓ Anesthésie-sédation
- ✓ Température des fluides infusés
- ✓ Transfusions sanguines

### BLOC OPÉRATOIRE

- ✓ Environnement
- ✓ Patient dénudé
- ✓ Anesthésie-sédation
- ✓ Température des fluides infusés
- ✓ Transfusions sanguines
- ✓ Ouverture des cavités thoracique et/ou abdominale



## - LUTTE CONTRE L'HYPOTHERMIE



Jurkovich, J Trauma 1987

## - LUTTE CONTRE L'ACIDOSE (réglages respi++)



## - LUTTE CONTRE L'HYPOCALCÉMIE





# RESUSCITATIVE STRATEGIES IN TRAUMATIC HEMORRHAGIC SHOCK

## III. Tissue oxygenation, type of fluid and temperature management

### R13 Tissue oxygenation \*\*\*

A target systolic blood pressure of 80-90 mmHg should be employed until major bleeding has been stopped in the initial phase following trauma without brain injury. A mean arterial pressure  $\geq 80$  mmHg should be maintained in patients with severe TBI.

### R14 Restricted volume replacement \*\*\*

A restricted volume replacement strategy should be used to achieve target blood pressure until bleeding can be controlled.

### R15 Vasopressors and inotropic agents \*\*\*

In addition to fluids, vasopressors should be administered to maintain target blood pressure in the presence of life-threatening hypotension. An inotropic agent should be infused in the presence of myocardial dysfunction.

# RESUSCITATIVE STRATEGIES IN TRAUMATIC HEMORRHAGIC SHOCK

## V. Initial management of bleeding and coagulopathy

### R23 Coagulation support \*\*\*

Monitoring and measures to support coagulation should be initiated immediately upon hospital admission.

### R24 Initial resuscitation \*\*\*

Initial management of patients with expected massive haemorrhage should include either plasma (FFP or pathogen-inactivated plasma) in a plasma-RBC ratio of at least 1:2 as needed or fibrinogen concentrate and RBC according to Hb level.

### R25 Antifibrinolytic agents \*\*\*

TXA should be administered as early as possible to the trauma patient who is bleeding or at risk of significant haemorrhage at a loading dose of 1 g infused over 10 min, followed by an i.v. infusion of 1 g over 8 h.  
TXA should be administered to the bleeding trauma patient within 3 h after injury. Protocols for the management of bleeding patients might consider administration of the first dose of TXA en route to the hospital.

## VI. Further resuscitation

### R26 Goal-directed therapy \*\*\*

Resuscitation measures should be continued using a goal-directed strategy guided by standard laboratory coagulation values and/or viscoelastic tests.

### R27 Plasma \*\*\*

In a plasma-based coagulation strategy plasma (FFP or pathogen-inactivated plasma) should be administered to maintain PT and APTT < 1.5 times the normal control. Plasma transfusion should be avoided in patients without substantial bleeding.

### R28 Fibrinogen & cryoprecipitate \*\*\*

If a concentrate-based strategy is used, fibrinogen concentrate or cryoprecipitate should be administered if significant bleeding is accompanied by viscoelastic signs of a functional fibrinogen deficit or a plasma fibrinogen level of less than 1.5-2.0 g/l. An initial fibrinogen supplementation of 3-4 g, equivalent to 15-20 single donor units of cryoprecipitate or 3-4 g fibrinogen concentrate may be administered. Repeat doses must be guided by viscoelastic monitoring and laboratory assessment of fibrinogen levels.

### R29 Platelets \*\*\*

Platelets should be administered to maintain a platelet count  $>50 \times 10^9/l$ . A platelet count  $>100 \times 10^9/l$  in patients with ongoing bleeding and/or TBI may be maintained. If administered, an initial dose of 4-8 single platelet units or one aphaeresis pack may be used.

**MERCI DE VOTRE ATTENTION**