DAMAGE CONTROL RESUSCITATION

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SFAR jeunes

Université de Lyon | Université Claude Bernard Lyon 1

Hospices Civils de Lyon

CONFLIT D'INTÉRÊT

- **LFB / Werfen : Consulting**

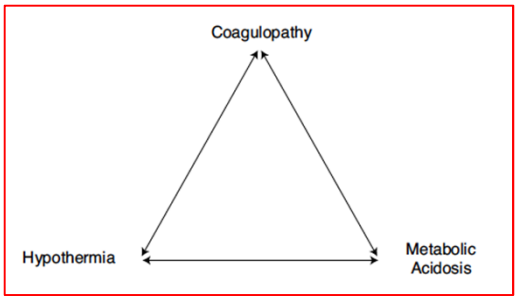
INTRODUCTION

- 40 % des décès post traumatiques = **Hémorragie**
- Hémorragie = Principale cause de Décès Evitable < 24h
- Coagulopathie : 20 à 30 % des trauma admis au Déchocage

Brohi K et al. Curr Opin Crit Care 2007

- Choc Hémorragique = Stratégie DCR (Traitement des facteurs qui vont exacerber l'hémorragie)

- **« Damage Control Resuscitation » :**
  - Low Volume Resuscitation / Hypotension permissive
  - PEC de la Triade Létale : Hypothermie, Acidose, Coagulopathie
  - Timing de PEC : Diagnostic et TT Précoce (Med, Chir, Radio)



SFAR jeunes

DAMAGE CONTROL RESUSCITATION

CHOC HEMORRAGIQUE =

De combien de Temps je dispose ?

TACTICAL DC


Tactical damage control resuscitation in austere military environments

Yann Daniel, S Habas, L Malan, J Escarment, J-S David, S Peyrefitte

PREHOSPITALIER

- Evaluer
- Orienter
- Traiter DV

DC SURGERY

- Hemostase
- Coprostase
- Xie < 2 heures

DCR

PROTOCOLES / REGLES
TRANSFUSION MASSIVE

Eviter « Lady-Di Syndrome »

DCR OUI MAIS POUR QUELS PATIENTS ?

DES LE PREHOSPITALIER

Identifier les Patients : Trauma Fermé ou Pénétrant

- Evaluation clinique gravité : membre arrachée, plaie sévère …
- Biologie Déportée :
  - Hemoccue < 110 g/L / TQr > 1.2
- Constantes vitales :
  - PAS < 90 / ACR …
  - Shock Index (FC/SBP) > 1.0
- Intensité réanimation :
  - RV > 1 L et/ou NADN +

David JS et al. Vox Sang 2017

Différencier les Patients !

- Choc hémorragique, GCS > 9, ventilation ok : **SCOOP AND RUN !!**
- TCG : Médicalisation ++ : **PLAY AND … RUN** !

A L'ADMISSION :

- **When to employ damage control.**
  - Use damage control in patients who present with or are at risk for developing:
    - Multiple life-threatening injuries.
    - Acidosis (pH <7.25).
    - Hypothermia (temperature <34°C).
    - Shock on presentation.
    - Combined hollow viscus and vascular or vascularized organ injury.
    - Coagulopathy (INR >1.4).
    - Mass casualty situation.

CHOC HEMORRAGIQUE = CIRCUIT PATIENT

TRAUMA CENTER = CIRCUIT ORGANISE !!!!!

Réveil

DECHOCAGE

BLOC OPERATOIRE

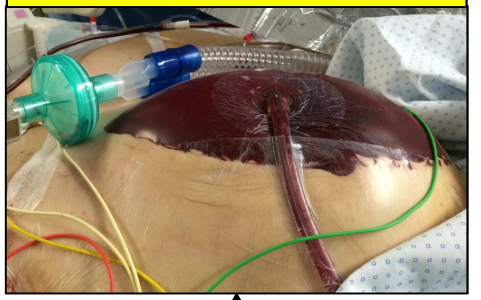
< 2 heures !!

SSPI : HEMOSTASIS SURVEY

12-48 h

REANIMATION

Débit redon < 50 ml/h
Correction : T° / pH / TIC
Survey : 2-4 h

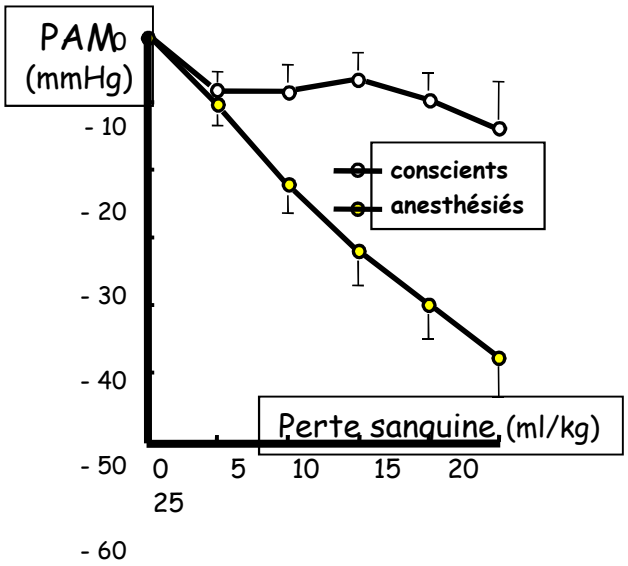


ADMISSION DIRECTE BLOC OPERATOIRE

Choc Hémorragique
Sauvetage

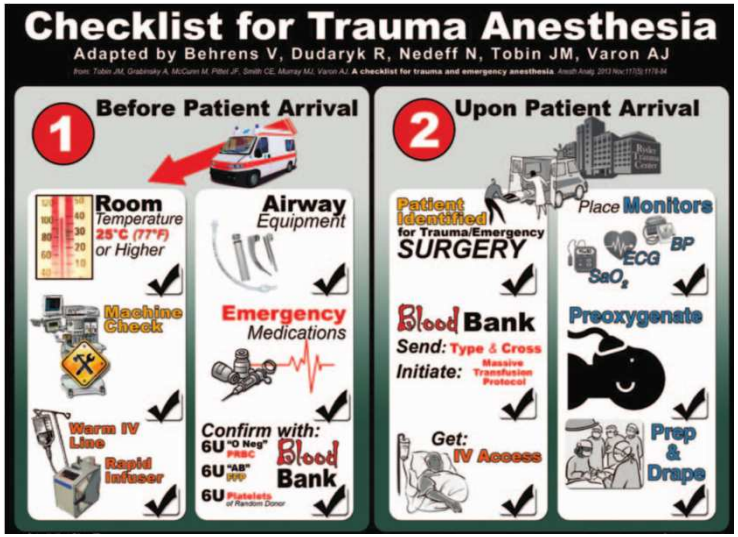
Laparotomie
Thoracotomie
Hémostase Mbre
REBOA

CHOC HEMORRAGIQUE = QUELLE ANESTHESIE ?



Induction Etat de Choc Hémorragique = Très Haut Risque d'AC

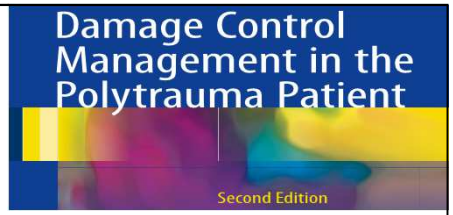
- Remplir / Transfusion juste avant !
- Si Bradycardie = pré-AC = CI Atropine !!!
- Induction quand table prête / patient « shampé » / Chir Ok
- Produit avec le moins d'effet sur le système sympathique
- Kétamine / Célo puis Kétamine IVSE / Tracrium
- Qd hémostase faite : Entretien « Classique »



DAMAGE CONTROL RESUSCITATION

1. **LIMITER LE SAIGNEMENT :** HÉMOSTASE / HYPOTENSION PERMISSIVE
2. **LIMITER L'HÉMODILUTION :** LOW VOLUME RESUSCITATION / NADN
3. **PEC DE LA TRIADE LÉTALE :** HYPOTHERMIE, ACIDOSE, COAGULOPATHIE
4. **TIMING DE PEC :**  DIAGNOSTIC ET TT PRÉCOCE (MED, CHIR, RADIO)

Abréger toutes les étapes pour obtenir l'hémostase !!



Damage Control Resuscitation 6

Eric J. Voiglio, Bertrand Prunet, Nicolas Prat, and Jean-Stéphane David

6.1 Introduction

Damage control resuscitation (DCR) for trauma, initially described to address the entire lethal triad immediately upon admission to a combat hospital before damage control surgery (DCS) [1], is now accepted as part of an integrated approach DCR-DCS from point of wounding to definitive treatment [2]. Therefore, DCR can be

divided in two steps: while bleeding is ongoing and once bleeding has been stopped.

6.1.1 Physiological Bleeding Control

When bleeding occurs, the baroreceptors located in the aortic arch and carotid sinus detect the drop in arterial pressure. This information is transmitted to the brain stem, which immediately increases sympathetic tone [3]. This increased sympathetic tone causes tachycardia (oxygen transportation is ensured by less blood that circulates faster) and vasoconstriction which favours the blood circulation of the heart and brain at the expense of all other organs and tissues (gut, kidney, muscle and skin). Vasoconstriction at the bleeding site decreases bleeding flow and allows platelets and the activated coagulation factors to seal the leak by a vascular clot [4] (Fig. 6.1). Fibrinolysis regulates coagulation [5] and prevents vascular occlusion. In favourable cases, the bleeding has stopped or slowed. In unfavourable

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Course à l'Hémostase

STOP THE BLEEDING !!!

- **HÉMOSTASE PRÉCOCE +++**
  - Suture des Plaies (agrafes …)
  - Ceinture de Bassin : systématique (trauma grave de bassin)
  - Garrot si échec compression directe (OPEX Irak, Afghanistan)
  - Pansement Hémostatique type « Quickclot Combat Gauze »
  - Sondes à Ballonnet (*Epistaxis Balloon Catheter*)

REBOA ?

7,62 mm

DAMAGE CONTROL RESUSCITATION

- **Hypotension Artérielle Permissive (Pas de TCG !!)**
  - **Respect des objectifs tensionnels** : PAS 80-90 mmHg
    - Notion de « rebleeding point » : 90 mmHg
  - **Limitation du Remplissage** :
    - Hémodilution, fragilisation caillot, hypothermie
    - Titration du volume pour objectif PAS
    - Cristalloïdes / Solutés Balancés : Isofundine / RL
    - HEA – Gélatines : Et pourquoi pas ? < 15-20 ml/kg ?

Agitation ≠ Trauma Crânien

Lewis SR et al. Cochrane Database Syst Rev 2018

Attempting to achieve normotension during active haemorrhage consistently increased mortality.[28]

has been stopped in the initial phase following trauma without brain injury. (Grade 1C)

Recommendation 15

We suggest administration of vasopressors to maintain target arterial pressure in the absence of a response to fluid therapy. (Grade 2C)

Recommandations sur la réanimation du choc hémorragique

Rossaint et al. Critical Care (2016) 20:100
DOI 10.1186/s13054-016-1265-x

Critical Care

RESEARCH Open Access

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

Dutton RP. Brit J Anaesth 2012

Hypotensive Resuscitation Strategy

ORIGINAL ARTICLE

Hypotensive Resuscitation Strategy Reduces Transfusion Requirements and Severe Postoperative Coagulopathy in Trauma Patients With Hemorrhagic Shock: Preliminary Results of a Randomized Controlled Trial

C. Anne Morrison, MD, MPH, Matthew M. Carrick, MD, Michael A. Norman, MD, Bradford G. Scott, MD, Francis J. Welsh, MD, Peter Tsai, MD, Kathleen R. Liscum, MD, Matthew J. Wall, Jr., MD, and Kenneth L. Mattox, MD

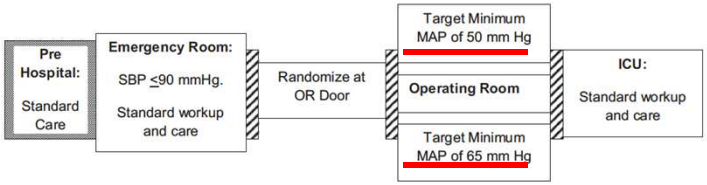


Diagram of the patient flow from left to right.

Results: Patients in the LMAP group received a significantly less blood products and total IV fluids during intraoperative resuscitation than those in the HMAP group. They had significantly lower mortality in the early postoperative period and a nonsignificant trend for lower mortality at 30 days. Patients in the LMAP group were significantly less likely to develop immediate postoperative coagulopathy and less likely to die from postoperatively bleeding associated with coagulopathy. Among those who developed coagulopathy in both groups, patients in the LMAP group had significantly lower international normalized ratio than those in the HMAP group, indicating a less severe coagulopathy.
Conclusions: Hypotensive resuscitation is a safe strategy for use in the trauma population and results in a significant reduction in blood product transfusions and overall IV fluid administration. Specifically, resuscitating patients with the intent of maintaining a target minimum MAP of 50 mm Hg, rather than 65 mm Hg, significantly decreases postoperative coagulopathy and lowers the risk of early postoperative death and coagulopathy. These preliminary results provide convincing evidence

Submitted for publication March 26, 2010.
Accepted for publication January 4, 2011.

From the Department of Surgery, Baylor College of Medicine, Houston, Texas.
Presented at the 40th Annual Meeting of the Western Trauma Association, February 28–March 6, 2010, Telluride, Colorado.
Address for reprints: C. Anne Morrison, MD, MPH, Michael E. DeBakey, Department of Surgery, Baylor College of Medicine, Houston, TX; email: camorris@bcm.edu.

DOI: 10.1097/TA.0b013e31820e77ea

modalities, have not been extensively tested in prospective, randomized clinical trials.

Hypotensive resuscitation has recently been advocated as an alternative to the current standard of care. In contrast to standard fluid resuscitation, this strategy uses less fluids and blood products during the early stages of treatment for hemorrhagic shock. Although intraoperative hypotensive resuscitation has not been prospectively tested in a surgical trauma setting, it has been successfully used in animal models[6] and has also been safely used in patients undergoing elective operations.[7–11] To our knowledge, this study is the first randomized, prospective study of intraoperative hypotensive resuscitation for trauma in human subjects. The aim of this study is to assess patient outcomes after accrual of 90 patients to establish the safety of a hypotensive resuscitation strategy including its effects on intraoperative fluid administration, bleeding, postoperative complications, and mortality within the trauma population. Our hypothesis is that patients randomized to a hypotensive resuscitation strategy will have decreased transfusion and intraoperative fluid utilization, decreased transfusions, decreased operative blood loss, decreased postoperative coagulopathy, comparable postoperative morbidity, and decreased mortality compared with patients randomized to a standard fluid resuscitation strategy.

TABLE 6. Intraoperative Fluids

	MAP = 50 mm Hg				MAP = 65 mm Hg				
	n	Mean	SD	CI	n	Mean	SD	CI	*p*
IVF									
Crystalloid (mL)	44	2,883	1,921	2,299–3,467	46	3,282	2,010	2,667–3,866	0.34
Colloid (mL)	44	512	469	367–656	46	609	470	469–748	0.33
Blood products									
PRBC (mL)	44	1,335			46	2,244	2,466	1,512–2,977	0.05
FFP (mL)	44	198	471	54–341	46	528	860	272–783	0.02
Platelets (mL)	44	61	214	3–137	46	114	242	42–186	0.27
Total inputs									
Non-blood products (mL)	44	3,438	2,103	2,791–4,086	46	3,875	2,098	3,252–4,498	0.33
Blood products (mL)	44	1,594			46	2,898	3,299	1,918–3,877	0.03
Total fluids	44	5,070	3,631	3,952–6,187	46	6,762	4,559	5,408–8,116	0.06
Total outputs									
Estimated blood loss (mL)	44	1,964	2,215	1,290–2,637	46	3,008	2,948	2,132–3,883	0.06
Urine output (mL)	40	272	284	181–363	40	347	353	234–460	0.29
Total fluid balance	40	3,026	2,470	2,225–3,826	40	3,089	2,383	2,327–3,851	0.90

- ↘ Décès Précoce Post Opératoire
  - 1/44 (**2**%) vs. 8/46 (**17**%), p=0.03
- ↘ Décès Précoce (ICU)
- **J30 (p=0.33)**

Carrick MM et al. J Trauma 2016

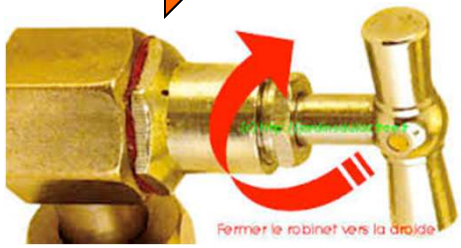
DUREE HYPOTA PERMISSIVE ?

La Plus Courte Possible !! : hypoperfusion tissulaire, MOF …
Peu de Données Scientifiques / Dépends Terrain, Sévérité Trauma, Type de lésion

HÉMOSTASE

HYPOTENSION PERMISSIVE

NORMOTENSION



DAMAGE CONTROL RESUSCITATION

- **Hypotension Artérielle Permissive (Pas de TCG !!)**
  - **Respect des objectifs tensionnels** : PAS 80-90 mmHg
    - Notion de « rebleeding point » : 90 mmHg
  - **Limitation du Remplissage** :
    - Titration du volume …
  - **Utilisation précoce** des Vasopresseurs :
    - NADN

- **Correction Triade Létale**
  - Hypothermie :
    - Diminuer exposition au froids = rapidité évacuation
    - Réchauffement patient / solutés
  - Acidose métabolique :
    - Améliorer perfusion tissulaire = corriger une anémie (CGR)
  - Coagulopathie

Beekley AC. Crit Care Med 2008
Duchesne JC et al. J Trauma 2010
Voiglio Ej et al. Management of the Polytrauma patient 2018

COAGULOPATHIE TRAUMATIQUE

Fréquente / dépend du RV / sévérité trauma, timing PEC …

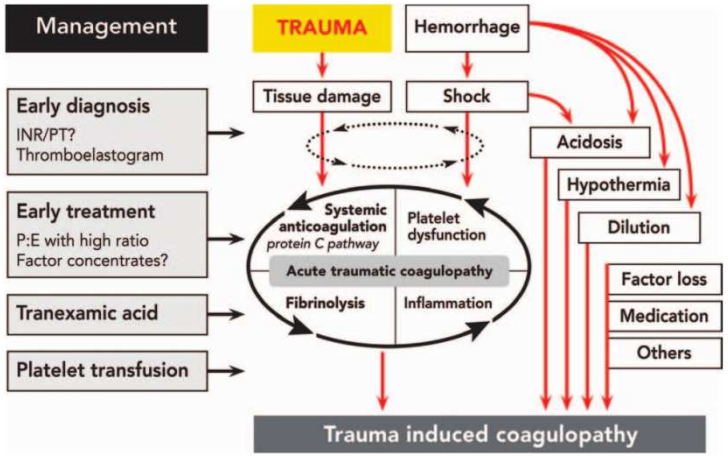
EDUCATION

Bruno Riou, M.D., Ph.D., Editor

Case Scenario: Management of Trauma-induced Coagulopathy in a Severe Blunt Trauma Patient

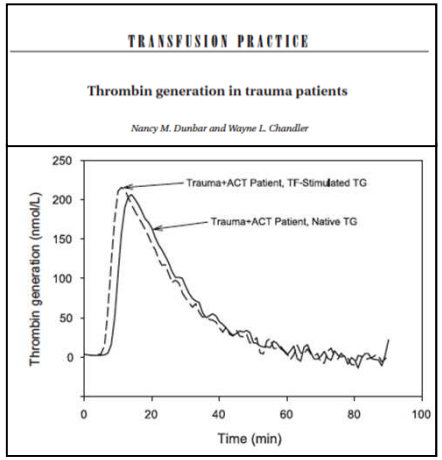
Jean-Stephane David, M.D., Ph.D.,* Anne Godier, M.D., Ph.D.,† Yesim Dargaud, M.D., Ph.D.,‡ Kenji Inaba, M.D., M.Sc.§

Anesthesiology, V 119 • No 1 191 July 2013



1. **Déficit en Fibrinogène Précoce**
2. **Génération de Thrombine**
   - Augmentée (ISS < 40)

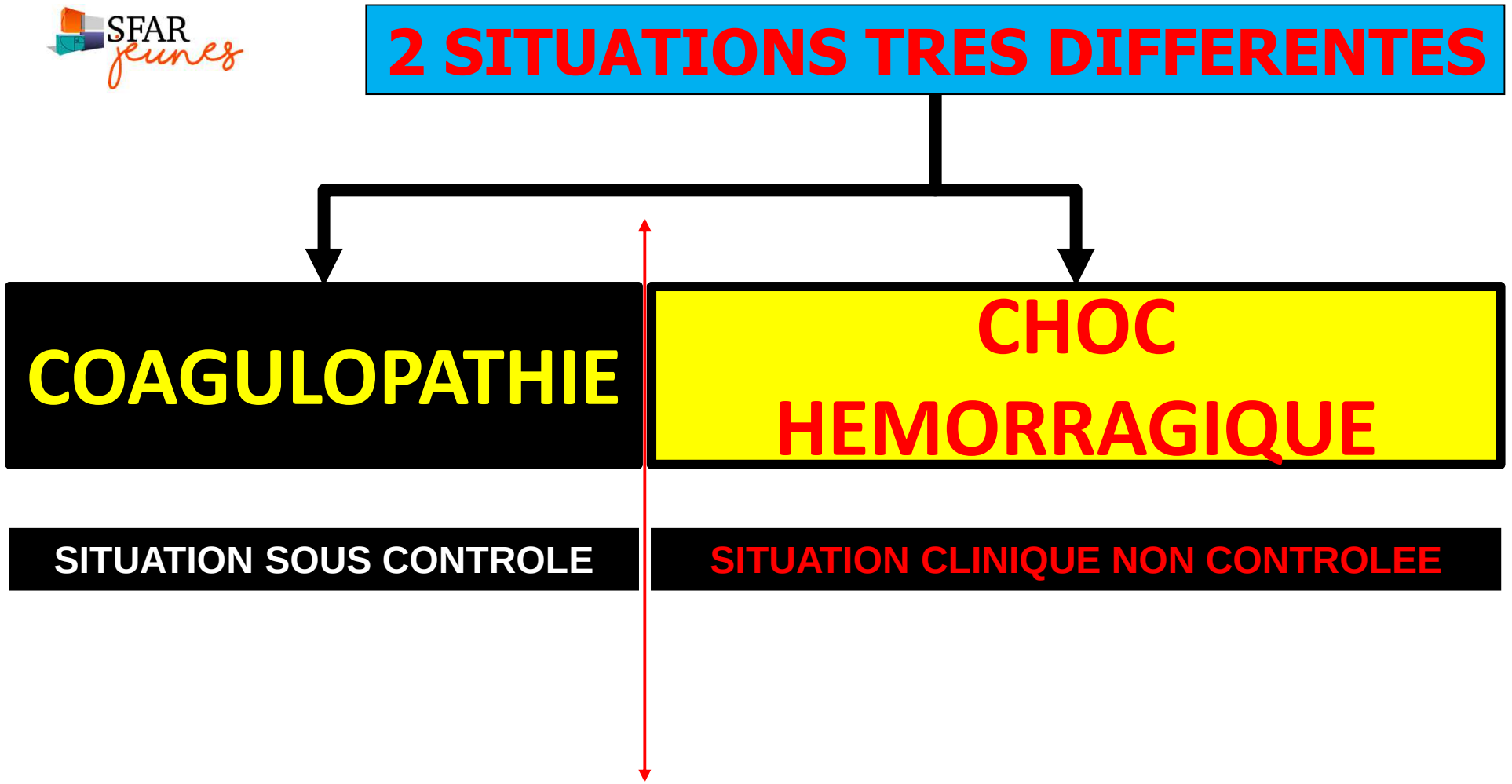
Dunbar N et al. Transfusion 2009
Davenport RA et al. Anesthesiology 2017



   - Diminuée (ISS > 40)

Taverna XJ et al. SFAR 2017

3. **Diminution tardive des Plaquettes**


2 SITUATIONS TRES DIFFERENTES
COAGULOPATHIE
CHOC HEMORRAGIQUE
SITUATION SOUS CONTROLE
SITUATION CLINIQUE NON CONTROLEE

COAGULOPATHIE

1. **Monitoring**
   - Techniques Viscoélastiques +++ (ROTEM/TEG)
   - Biologie Standard par défaut
2. **CGR** pour : Hgb 7 - 9 gr/dL
3. **Fibrinogène** si : < 1.5 gr/L
   - < 50 kg : 1,5 gr
   - 50-80 kg : 3 gr
   - > 80 kg : 4,5 gr

TXA < H3

4. **PFC** si : TP < 40 %
   - PFC : 10-15 ml/kg
   - (PCC : 20-25 UI/kg)
5. **Plaquette** si : < 50 G/L
   - < 100 Hémorragie active/TCG
6. **Répéter Biologie / h – 2h**


Critical Care

RESEARCH Open Access

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

Recommandations formalisées d'experts

SFAR

Recommandations sur la réanimation du choc hémorragique

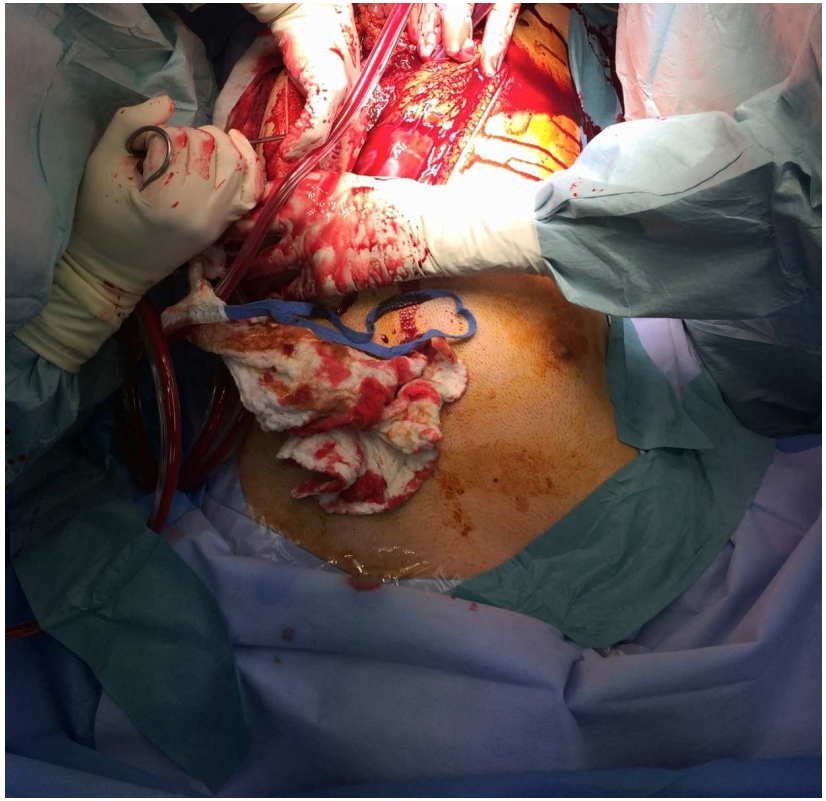
Guidelines on the treatment of hemorrhagic shock

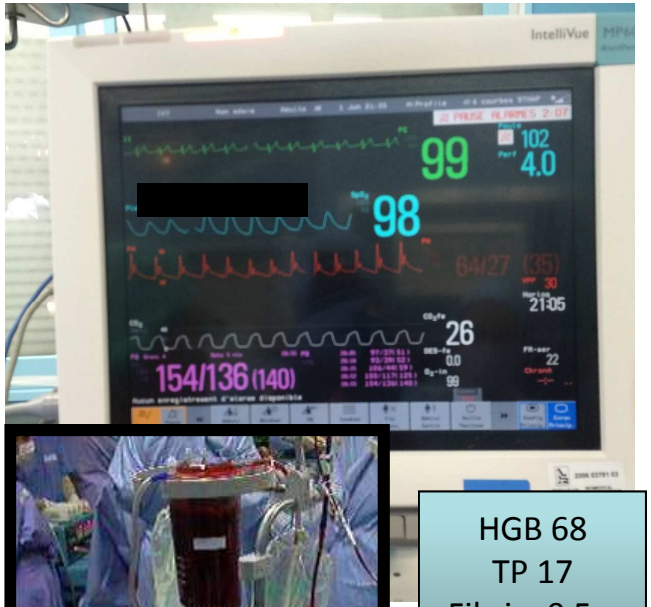
SITUATION SOUS CONTROLE

First Line Hemostatic Agent: Fibrinogen

CHOC HEMORRAGIQUE

SITUATION CLINIQUE NON CONTROLEE





HGB 68
TP 17
Fibri < 0,5 g

NADN 6mg/h
RV > 5L

CHOC HEMORRAGIQUE

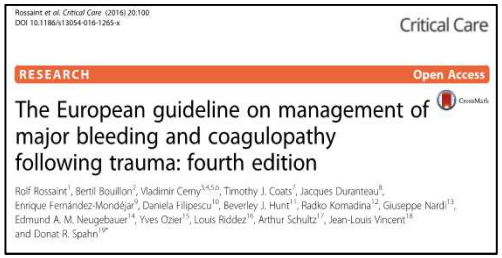
SITUATION CLINIQUE NON CONTROLEE

Four Fives : 5 – 5 – 5 – 5 !

Bloc Lyon Sud

- **ASSOCIE LES PRODUITS !**
- CGR + PFC + Fibrinogène puis PLT …
- Exacyl systématique !
- Hypothermie
- Acidose (Bicar ?, CGR)
- **Protocole de Transfusion Massive**
  - Composition : CGR/FIB/PFC (PLT dès 6 CGR)
  - Soit Règle sur « mesure »
    - CGR selon Hgb - PFC 20-30 ml/kg - Fib 50-75 mg/kg
  - Soit Ratio 1:1:1 (CGR/FIB/PFC) – Bon ratio ??
    - **+ Ca^{2+}**

Ratio = TM !!



Rossaint et al. Critical Care (2016) 20:100
DOI 10.1186/s13054-016-1265-x

Critical Care

RESEARCH Open Access

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

Rolf Rossaint[1], Bertil Bouillon[2], Vladimir Cerny[3,4,5,6], Timothy J. Coats[7], Jacques Duranteau[8], Enrique Fernández-Mondéjar[9], Daniela Filipescu[10], Beverley J. Hunt[11], Radko Komadina[12], Giuseppe Nardi[13], Edmund A. M. Neugebauer[14], Yves Ozier[15], Louis Riddez[16], Arthur Schultz[17], Jean-Louis Vincent[18] and Donat R. Spahn[19*]

Recommandations formalisées d'experts

SFAR

Recommandations sur la réanimation du choc hémorragique

Guidelines on the treatment of hemorrhagic shock

Jacques Duranteau[a,], Karim Asehnoune[b], Sébastien Pierre[c], Yves Ozier[d], Marc Leone[e], Jean-Yves Lefrant[f], et 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) et du Groupe d'études sur l'hémostase et la thrombose (GEHT)*

CHOC HEMORRAGIQUE NON CONTROLE ?

CGR/CP + | **PFC ?!** | **+ FIB**

50 – 75 mg/kg

Ratio 1:1 ?
20-30 ml/Kg

→ **1 PFC = + 2,5 % TP …**

→ **TP 10 : 14**
TP 20 : 8
TP 30 : 4
TP 40 : 0

REVIEW

Fixed ratio versus goal-directed therapy in trauma

Herbert Schöchl[a,b], Marc Maegele[c], and Wolfgang Voelckel[a]

Purpose of review
This article compares the strategy of a fixed transfusion ratio of plasma and platelet concentrates to red blood cells to reconstitute 'whole blood' with the concept of individualized goal-directed coagulation therapy (GDCT).

Recent findings
Current data suggest that an early and high ratio of plasma and platelet concentrate transfusion, predominantly in a fixed 1 : 1 : 1 ratio with red blood cells, is associated with improved outcome. However, the optimal ratio is still under discussion. Moreover, storage time considerably affects the hemostatic competence of these products and no universal standard for the composition of these 'transfusion packages' has been established. Some European trauma centers instituted the concept of GDCT in trauma patients, which is based on early diagnosis of the coagulation deficit using point-of-care viscoelastic tests (VETs). These tests provide rapid information about the underlying hemostatic deficiencies, allowing targeted coagulation therapy according to the individual deficits of the patient. Treatment algorithms have been established for the administration of coagulation factor concentrates, and plasma and platelet concentrate based on VET results.

Summary
Individualized GDCT, guided by VET, offers several advantages over fixed ratio coagulation therapy. Studies comparing both hemostatic strategies are warranted.

Keywords
goal-directed coagulation therapy, ratio-driven coagulation therapy, trauma-induced coagulopathy, viscoelastic tests

INTRODUCTION

Despite substantial improvement in acute trauma care, uncontrolled bleeding remains the primary cause of preventable death [1,2]. Most of these patients die within 3–6 h of hospital admission [3]. Thus, many trauma centers implement massive transfusion protocols to rapidly identify patients at risk for massive transfusion and administer hemostatic agents without substantial time delay [4,5]. Recent data suggest that early transfusion of high ratios of plasma and platelet concentrate, predominantly in a fixed 1 : 1 : 1 ratio with red blood cells (RBCs), is associated with improved outcome in patients with severe bleeding [6••].

Some European trauma units have established a more targeted approach to treat coagulopathic trauma victims. Viscoelastic tests (VETs), most commonly rotational thromboelastometry (ROTEM, TEM International GmbH, Munich, Germany) or thrombelastography (TEG, Haemonetics Corporation, Niles, Illinois, USA), are used to evaluate the hemostatic capacity of trauma patients. Tailored hemostatic therapy, largely consisting of purified coagulation factor concentrates (CFCs), can then be applied [7–13].

FIXED RATIO COAGULATION THERAPY

The concept of damage-control resuscitation has been adopted in many military and civilian trauma centers [14,15], and is essentially based on restricted fluid therapy, permissive hypotension, and consequent maintenance of normothermia [14]. Early and aggressive transfusion of plasma has been

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Correspondence to Herbert Schöchl, AUVA Trauma Centre Salzburg, Austria and Ludwig Boltzmann Institute for Experimental and Clinical Traumatology, AUVA Research Centre, Donaueschingenstrasse 13, 1200 Vienna, Austria. Tel: +43.664 34 22 945; e-mail: herbert.schoechl@auva.at

Curr Opin Anesthesiol 2016, 29:234–244
DOI:10.1097/ACO.0000000000000278

ETAT DE CHOC HEMORRAGIQUE

- **SOIT ECOLE « US » « FAÇON B52 » = Gestion « Ratio Fixé »**
  - CGR selon hgb ou à l'aveugle
  - PFC:CGR 1:1
  - PLT : à partir de 4/6 CGR
  - ± Fibrinogène
  - ± Biologie (TEG)

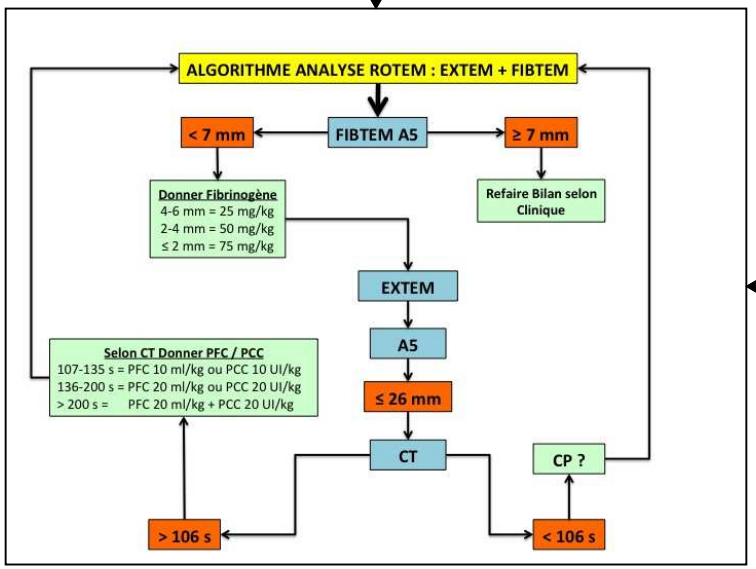
- **SOIT ECOLE « EUROPÉENNE » = Gestion « Guidée »**
  - « Mise de Départ » selon :
    - Clinique / Hemocue
    - CGR + PFC et/ou FIB
  - Puis adaptation selon VET (biologie) :
    - CGR selon Hgb
    - FIB / PFC / PLT selon
      - ROTEM / TEG +++
      - Biologie Standard
      - A faire / 1-2 h !!

SUSPICION DE COAGULOPATHIE

Trauma / HPP

SITUATION CLINIQUE SOUS CONTROLE

ROTEM / NFP



SITUATION CLINIQUE NON CONTROLEE

Damage Control Resuscitation

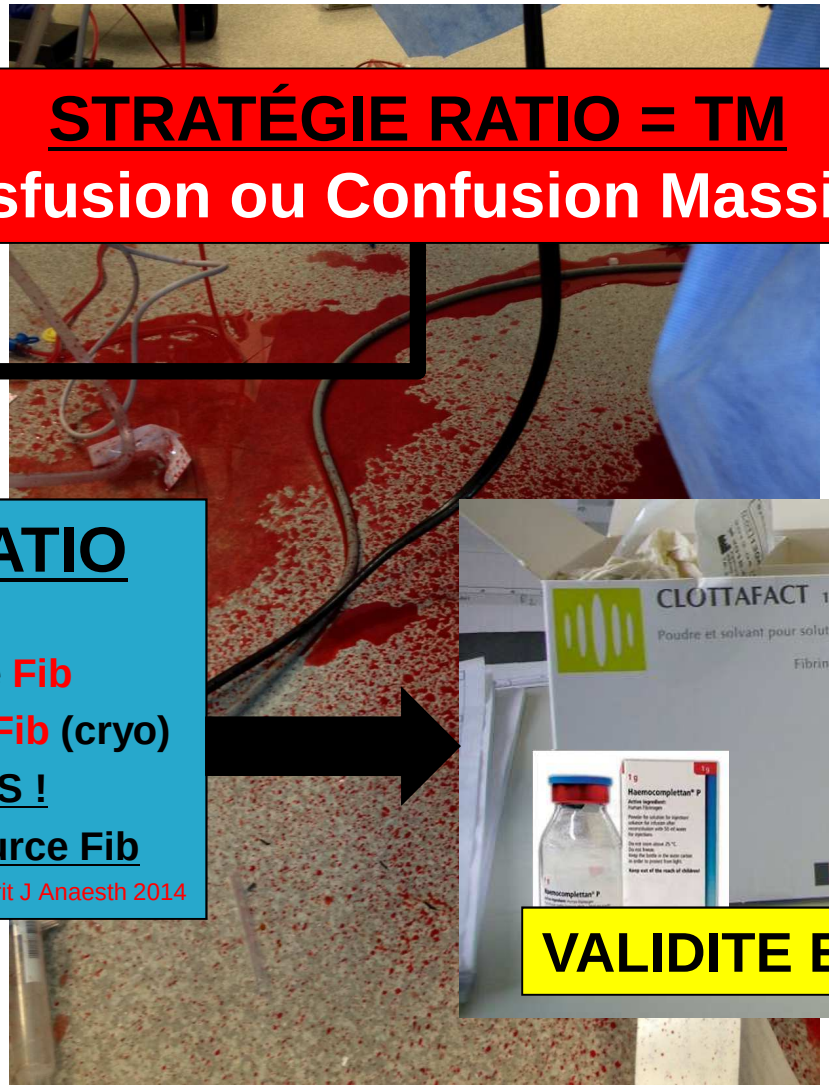
PAS 70-90 mmHg
LVR/NADN
DCS < 2h

CGR 0 : selon HemoCue
+ Clottafact : 50-75 mg/kg
± PFC (PLYO) : 20-30 ml/kg
TXA : 1 g

Algorithme *Lyon Sud*

STRATÉGIE RATIO = TM

Transfusion ou Confusion Massive !?



ETUDES RATIO

- Pas de TXA !!
- PROPPR : Pas de Fib
- PROMT : Peu de Fib (cryo)
- Fib : Pas de CF US !
- PFC : très mx source Fib

Collins PW et al. Brit J Anaesth 2014

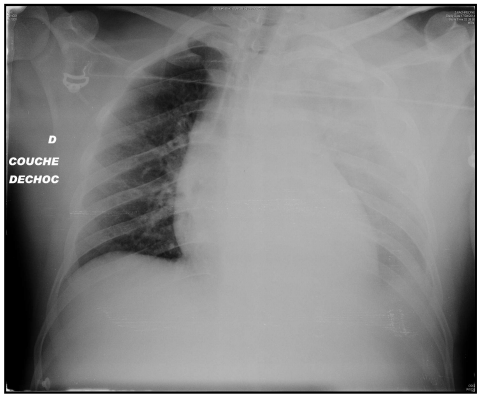
VALIDITE EN EUROPE ??

UN BON EXEMPLE !

- Agression arme blanche Lyon
- Plaie = para-sternale gauche
- SMUR : Tachycarde / TA impr / Sueur / Agitation
- VVP / O2 / Début RV …
- **<u>Transport immédiat et rapide</u>**

SMUR = 15 min !

< 10 min !



DECHOCAGE

- Admission : PAS < 75 mmhg / Fc 100 / Agitation et Sueur
- eFAST + / VVC + K ART – Appel Chir Thoracique
- T + 15 min : 1 AC / RACS puis après 5 min 2ème AC

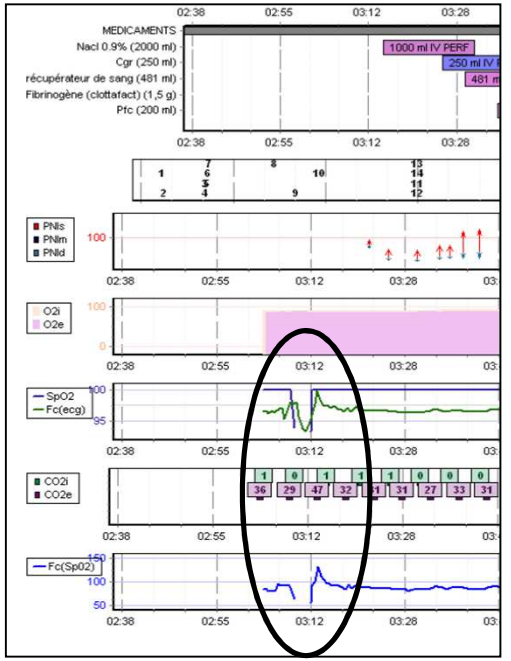
< 30 min !

3 g Fib débuté au Déchocage → **BLOC !!**

UN BON EXEMPLE !

- Posé en AC sur Table Opératoire
- Sternotomie de Sauvetage
- Plaie Tronc AP : Suture en quasi AC
- extubé H36 sans séquelle

- **Transfusion ?**
- 2 CGR
- 4,5 g FIB
- 1 PFC
- 2 g TXA



Adm	02h33	03h40
TP	59	36
Fib	2	1,6
Hgb	125	94
Ac L	12	11

Kétamine / Tracrium
puis
Desflurane / Sufenta

JAMA Surgery | Original Investigation

Association of Prehospital Mode of Transport With Mortality in Penetrating Trauma

A Trauma System–Level Assessment of Private Vehicle Transportation vs Ground Emergency Medical Services

Michael W. Wandling, MD, MS; Avery B. Nathens, MD, PhD; Michael B. Shapiro, MD; Elliott R. Haut, MD, PhD

IMPORTANCE Time to definitive care following injury is important to the outcomes of trauma patients. Prehospital trauma care is provided based on policies developed by individual trauma systems and is an important component of the care of injured patients. Given a paucity of systems-level trauma research, considerable variability exists in prehospital care policies across trauma systems, potentially affecting patient outcomes.

OBJECTIVE To evaluate whether private vehicle prehospital transport confers a survival advantage vs ground emergency medical services (EMS) transport following penetrating injuries in urban trauma systems.

DESIGN, SETTING, AND PARTICIPANTS Retrospective cohort study of data included in the National Trauma Data Bank from January 1, 2010, through December 31, 2012, comprising 298 level 1 and level 2 trauma centers that contribute data to the National Trauma Data Bank that are located within the 100 most populous metropolitan areas in the United States. Of 2 329 446 patients assessed for eligibility, 103 029 were included in this study. All patients were 16 years or older, had a gunshot wound or stab wound, and were transported by ground EMS or private vehicle.

MAIN OUTCOME AND MEASURE In-hospital mortality.

RESULTS Of the 2 329 446 records assessed for eligibility, 103 029 individuals at 298 urban level 1 and level 2 trauma centers were included in the analysis. The study population was predominantly male (87.6%), with a mean age of 32.3 years. Among those included, 47.9% were black, 26.3% were white, and 18.4% were Hispanic. Following risk adjustment, individuals with penetrating injuries transported by private vehicle were less likely to die than patients transported by ground EMS (odds ratio [OR], 0.38; 95% CI, 0.31-0.47). This association remained statistically significant on stratified analysis of the gunshot wound (OR, 0.45; 95% CI, 0.36-0.56) and stab wound (OR, 0.32; 95% CI, 0.20-0.52) subgroups.

CONCLUSIONS AND RELEVANCE Private vehicle transport is associated with a significantly lower likelihood of death when compared with ground EMS transport for individuals with gunshot wounds and stab wounds in urban US trauma systems. System-level evidence such as this can be a valuable tool for those responsible for developing and implementing policies at the trauma system level.

Supplemental content

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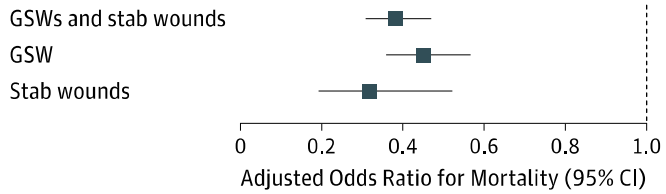
JAMA Surg. doi:10.1001/jamasurg.2017.3601
Published online September 20, 2017.

Private Vehicle vs. EMS

Figure 2. Risk-Adjusted Odds Ratios For Mortality For Private Vehicle Transport When Compared With Ground Emergency Medical Services Transport



CONCLUSION

- **Stratégie de PEC ++ = DCR si état de choc !**
- **EXACYL : Systématique**
- **Agir vite en cas de Coagulopathie : !!**
- **Check List Choc Hémorragique / Règle TM**
- **CIRCUIT PATIENT Identifié**
- **Procédures DCR connues et … appliquées !!**

« The Best Treatment of the Coagulopathy is … Surgery ! »