REMOTE DAMAGE CONTROL RESUSCITATION IN AUSTERE ENVIRONMENTS
&
PROLONGED FIELD CARE

« La tyrannie des délais
ou
comment prendre en charge un blessé de guerre dans le Septentrion »

04/12/2018

Dr MORAND[1] - Dr ZELLER[2]

1. *1ière CSS-FS/4ème Antenne Médicale Spécialisée*
2. *Commandement des Opérations Spéciales*

PLAN

- **Rappel d'épidémiologie :**

Le blessé de guerre , à quoi sommes nous confronté ?

- **Rappel de physiopathologie :**

A quoi devons nous faire face ?

- ***Damage Control Resuscitation*, quoi de neuf ?**

Remote DCR

Prolonged Field Care PFC

- ***So what* ?**

Les prérequis indispensables

RDCR et PFC : RAVINES

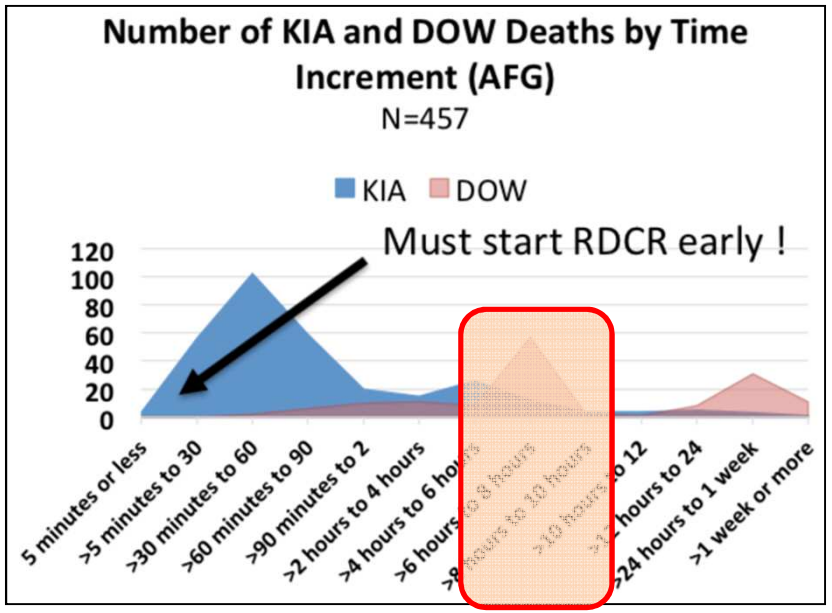
- **Conclusions**

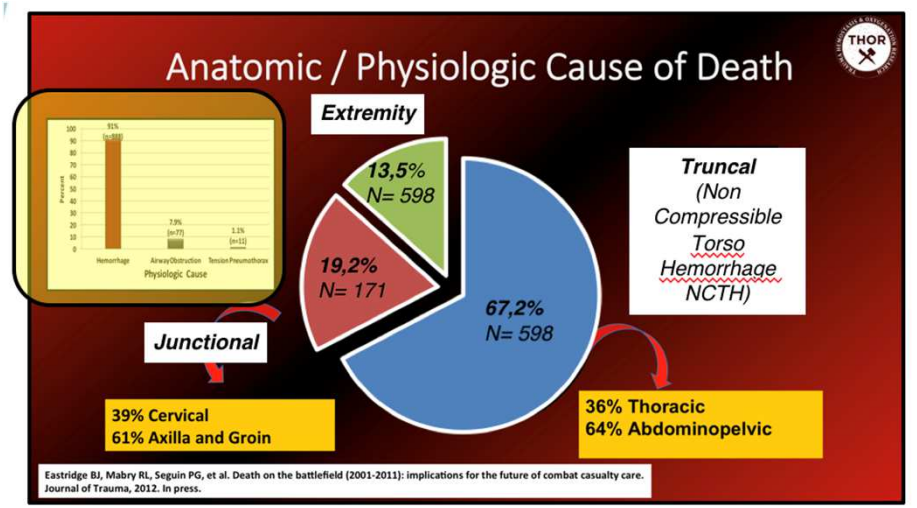
Service de santé des armées

RAPPEL D'EPIDEMIOLOGIE

- **Hémorragies :** 1ère cause de décès **évitables** chez le traumatisé militaire comme civil
- KIA 90% avant le bloc opératoire (2h)
- DOW pic après 6h

- Mortalité a/p 6h : incidence Trauma Brain Injury TBI





Shackelford et al, JTS 2016
Holcomb JB et al, (PROMMTT), JAMA Surg 2013
Eastridge BJ et al, J Trauma Acute Care Surg. 2012
Kotwal et al. Arch Surg 2011

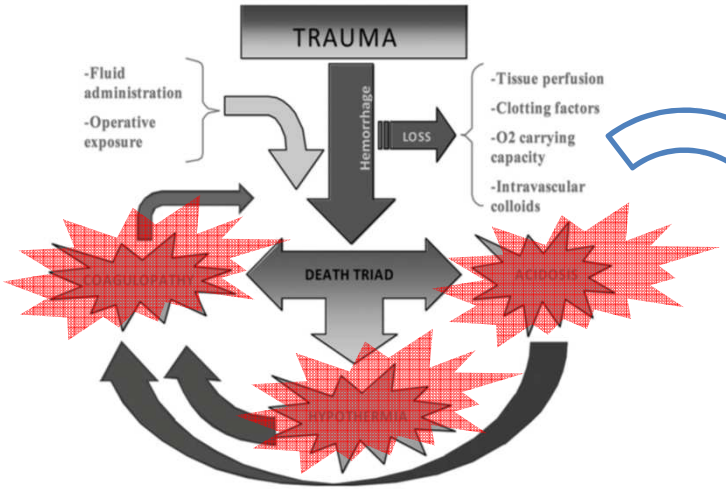
Service de santé des armées

RAPPEL DE PHYSIOPATHOLOGIE : LA TRIADE LETALE ET LA DETTE EN OXYGENE

The Journal of TRAUMA® Damage Control Resuscitation: The New Face of Damage Control

Juan C. Duchesne, MD, FACS, FCCP, Norman E. McSwain, Jr., MD, FACS, Bryan A. Cotton, MD, FACS,

Figure 1. Components involved in the development of the coagulopathy of trauma.



L'insuffisance hématologique globale de l'hémorragie grave

Hypoperfusion / **Hypoxie tissulaire**
Elévation Lactates

« Une intervention précoce pour prévenir les déséquilibre physiopathologiques à l'origine de la triade létale plus efficiente sur la survie à court et moyen terme qu'essayer de corriger le mécanisme auto-entrainé une fois qu'il est établi »

Hemorrhagic blood failure: Oxygen debt, coagulopathy, and endothelial damage

J Trauma Acute Care Surg
Volume 82, Number 6, Supplement 1

Nathan J. White, MD, MS, Kevin R. Ward, MD, Shibani Pati, MD, PhD, Geir Strandenes, MD, *and* Andrew P. Cap, MD, PhD

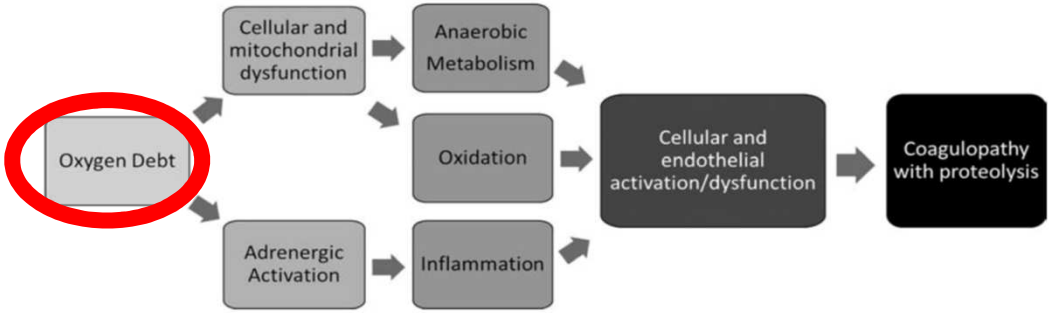


Figure 2. Schematic of key linkages between oxygen debt, cellular dysfunction, and coagulopathy during hemorrhagic blood failure.

Brohi et al. Acute traumatic coagulopathy. J Trauma 2003
Rugeri L, et al. J Thromb Haemost 2007
Simmons et al. Mechanism of injury affects acute coagulopathy of trauma in combat casualties. J Trauma 2011
Sebesta J. Special lessons learned from Iraq. Surg Clin North Am. 2006
Beekley AC. Damage control resuscitation: a sensible approach to the exsanguinating surgical patient. Crit Care Med. 2008

Service de santé des armées

Damage control Resuscitation, quoi de neuf ?

Prolonged evacuation >6h

SAUVETEURS COMBAT → *MEDIC ?* → *CHIRURGIENS & MAR*

>T+20min → *INFIRMIERS & MEDECINS*

MONDE IDEAL DES BISOUNOURS

Pas loin, pas tard, pas de sueur…. *Juste de quoi mettre le blessé en condition (<1h)* *Plateau Chir <2h* *HIA / CHU France 24h*

POI → Extraction, Garrot TQT → NID DE BLESSES / PRV → TCCC, SC1, SC2, SC3 et + → ..... → HLZ → En Route Care → MCV → R2 / R3 → STRATEVAC → H FRA

??? heures, jours ???

DC Ground Zero

Care Under Fire

Far Forward DC Resuscitation
Austere / Tactical DC R

Remote DC Resuscitation

Prolonged Field Care

1h…

DC Resuscitation

DC Surgery

« DCR addresses the entire lethal triad immediately upon admission to a combat hospital »

Holcomb JB, et al. Damage control resuscitation: directly addressing the early coagulopathy of trauma. J Trauma. 2007

Service de santé des armées

Damage control Resuscitation, quoi de neuf ?

PFC = notion de durée

PROLONGED FIELD CARE

Deconstructing the Definition of Prolonged Field Care

Journal of Special Operations Medicine

Sean Keenan, MD

Remote DCR (RDCR) = notion d'environnement et ressources dégradées

JOINT TRAUMA SYSTEM CLINICAL PRACTICE GUIDELINE (JTS CPG)

Damage Control Resuscitation (CPG ID: 18)
This CPG provides evidence–based guidance to minimize variation in resuscitation practices and improve the care of massively hemorrhaging, severely injured casualties.

Contributors

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First Publication Date: 18 Dec 2004 | Publication Date: 03 Feb 2017 | Supersedes CPG dated 01 Feb 2013

Opinions, interpretations, conclusions, and recommendations are those of the authors and are not necessarily endorsed by the Services or DoD.

Shock. 2014 May ; 41(0 1): 3–12. doi:10.1097/SHK.0000000000000140.

THOR Position Paper on Remote Damage Control Resuscitation: Definitions, Current Practice and Knowledge Gaps

Donald H. Jenkins, MD[1], Joseph F. Rappold, MD FACS[24], John F. Badloe, MD[4], Olle

Damage control resuscitation: lesson[illegible] · P. Harwood[1]

Eur J Trauma Emerg Surg (2016) 42:273–282
DOI 10.1007/s00068-015-0628-3

ORIGINAL ARTICLE

Fig. 3 Indication[illegible] damage control resuscitation

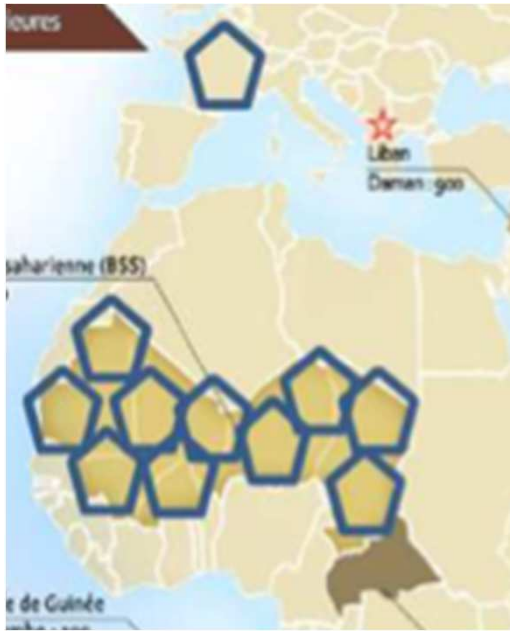
Anatomic Parameters	Physiologic Parameters	Lab Parameters
stimated ISS >36		Lactate >2.5mmol/L
Penetrating abdominal injuries	Weak or absent radial pulse	Platelet count < 90.000/ml
Penetrating chest injuries	Core body temperature <35'C	Fibrinogen >1g/dl
Open pelvic fracture	Systolic BP <100 mmHg	PT> 16 secs
ong bone # with head injury	Heart rate >100	INR >1.5
g bone # with lung contusion	PaO2/FiO2 <250	Hb <11
Trun l haemorrhage &	Urinary output <50ml/hour	pH <7.2
amputat		Base deficit <6

REMOTE DCR

DCR

Service de santé des armées

SO WHAT ?



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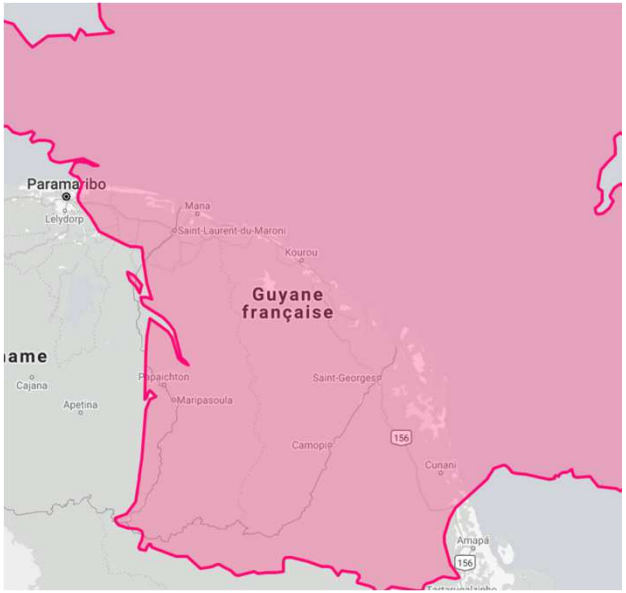
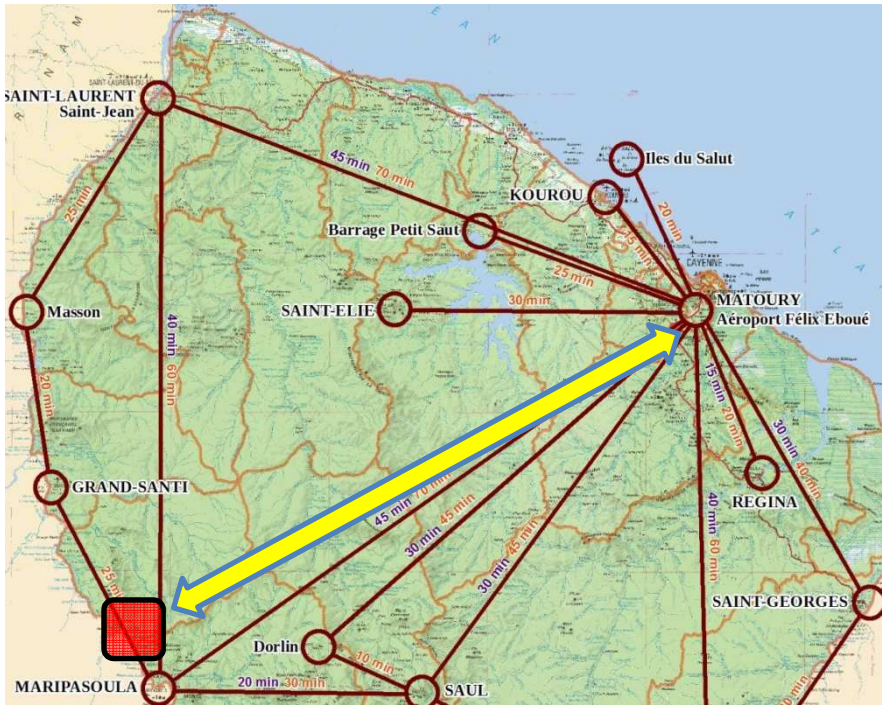
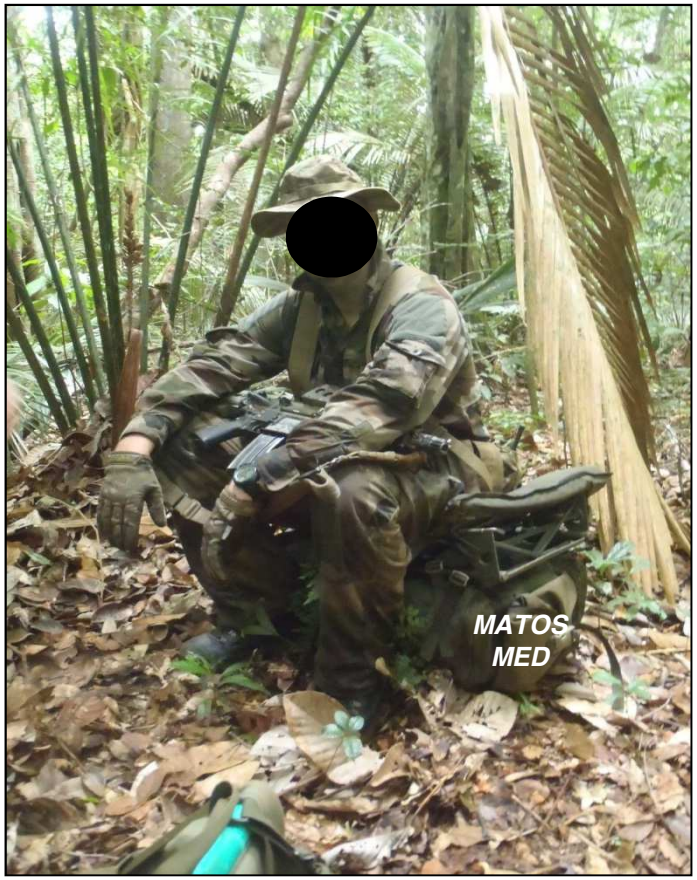
EXEMPLES…. France d'Outre-Mer



1 CH (Cayenne)
Mission pédestre de plusieurs jours en jungle, de nuit
Blessé thoracique grave par balle
Conditions météorologiques défavorables = pluie tropicale
➔ ***11h attente avant Evacuation***





Service de santé des armées

EXEMPLES…. Mégalopole

Remote damage control during the attacks on Paris: Lessons learned by the Paris Fire Brigade and evolutions in the rescue system

Xavier Lesaffre, MD, Jean-Pierre Tourtier, PhD, Yann Violin, MD, Benoit Frattini, MD, Catherine Rivet, MD, Olivier Stibbe, MD, Florian Faure, Anne Godefroy, Jean-Claude Gallet, MS, *and* **Sylvain Ausset, PhD**, *Paris, France*

130 morts (124 avant hôpital)
85 blessés
2640 pompiers 58 SMUR
40 hôpitaux
6 trauma center Level 1

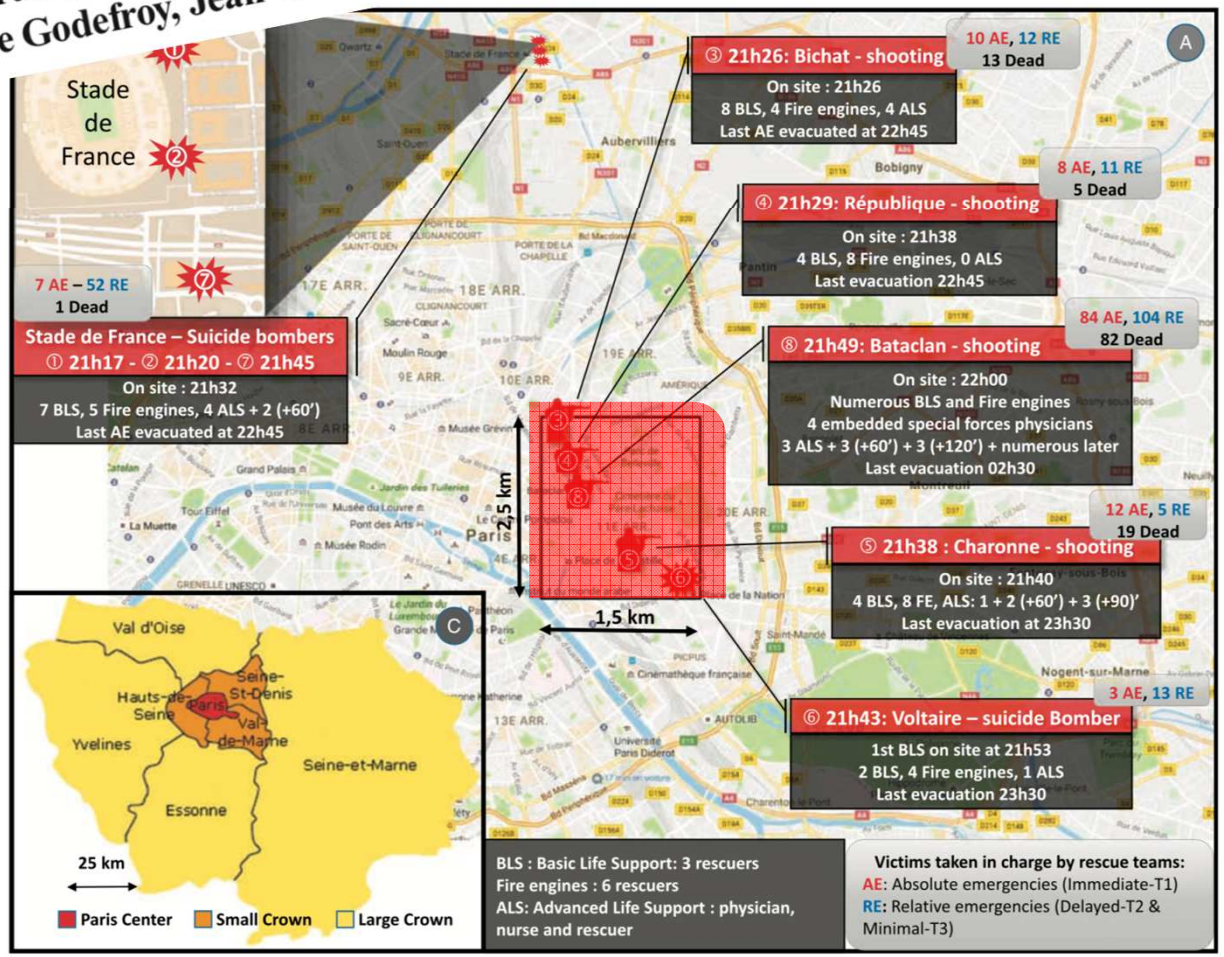


Figure 1. Map of November attacks. (*A*) Time line of the attacks and rescue operations. (*B*) Stade France bombings. (*C*) Ile de France Region.

SO WHAT ? Les prérequis : assurer l'essentiel, la survie à court terme

SAFE

STOP THE BURNING PROCESS

Eloigner / maitriser le danger

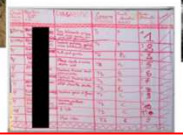
ASSESS THE SCENE

Evaluer la situation, l'environnement, le dispositif à mettre en place, anticiper, organiser…

FREE OF DANGER FOR YOU

Mettre équipe à l'abri ainsi que les blessés : Nid de de Blessés

➔ Extraction ?



EVALUATE

TRIAGE

Simple Triage And Rapid Treatment **ABC**

MARCHE

MASSIVE BLEEDING CONTROL

AIRWAYS

RESPIRATION

CHOC

VVP

VIO

Octopus 3 voies

Remplissage SSH 7,5% 250mL

Remplissage Brulé

HEAD / HYPOTHERMIE

Osmothérapie SSH 7,5% 125mL x2

(EVACUATE)

RYAN

REEVALUATION

Reprendre son MARCH

YEUX / ORL / MAINS (Fonctionnel)

ANALGESIE / ATB

Rassurer

Immobiliser

TTT Brulures

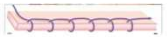
Analgésie IntraNasale (Kéta IN)

Analgésie multimodale IV

BIF

Amox-Ac Clavulanique 2g

FQ +/- Dalacine

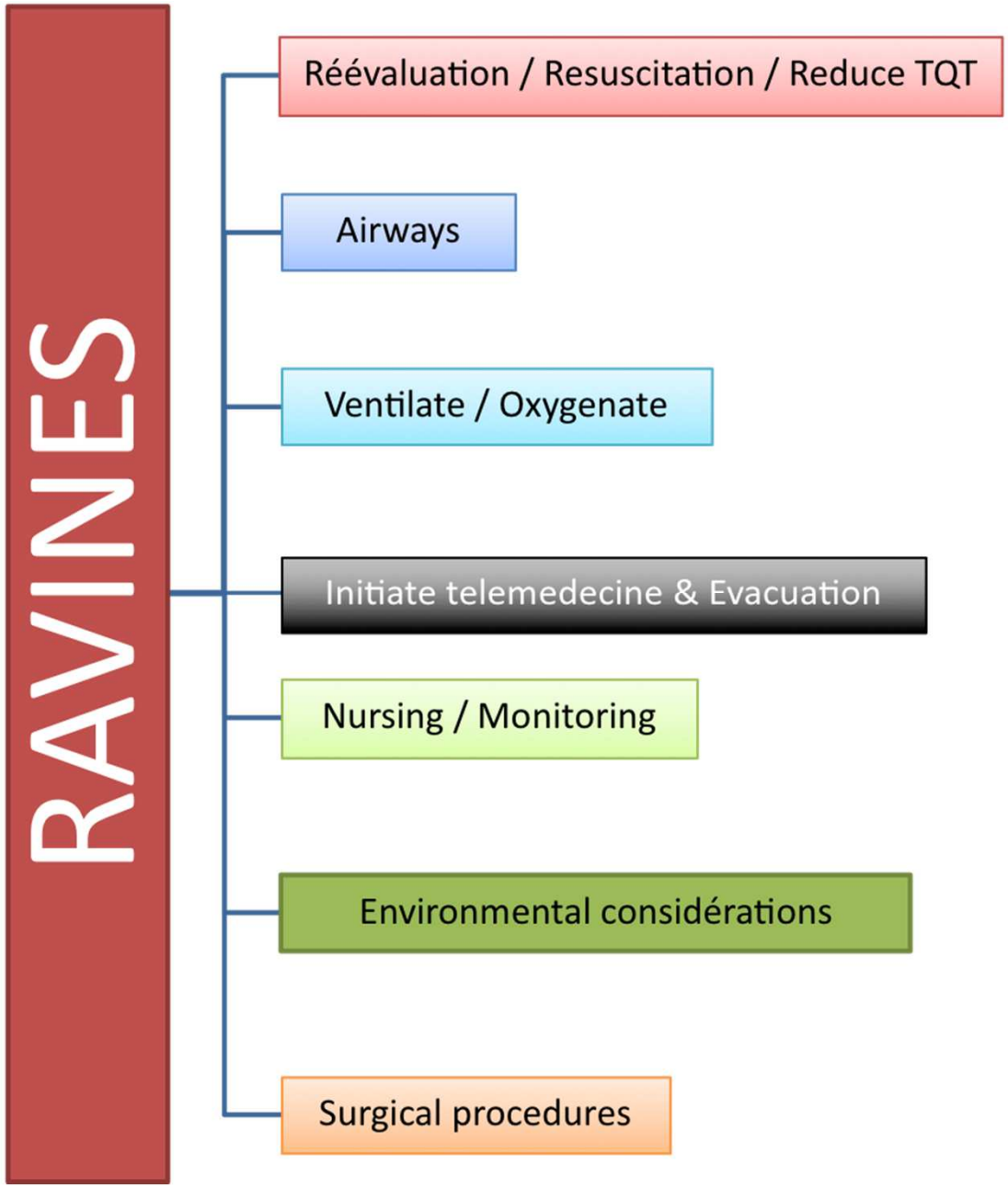


NETTOYAGE

Service de Santé des Armées, Ecole du Val-de-Grâce. Enseignement du Sauvetage au Combat. Référentiel de formation No 0309/EVDG/DPMO du 30 mars 2012

Service de santé des armées

SO WHAT ? Remote DCR



Service de santé des armées

Reevaluation / Resuscitation : HEMORRAGIES

Maitrise des hémorragie non contrôlables

- **Jonctionnelle :**

Kotwal RS et al. Management of junctional hemorrhage in combat casualty care: TCCC guidelines proposed change 13-03. J Spec Oper Med. 2013

Service de santé des armées

Réévaluation

La clinique seule ne suffit plus !

Le virage incontournable de l'échographie en médecine des forces. Bilan de dix ans d'utilisation et perspectives

médecine et armées, 2017, 45, 2, 205-212

C. Dubecq[a], L. Aigle[b, c], A. Couret[d], G. Morand[a], Y. Levaillant[a], B. Paklepa[a]

Figure 1. *Appropriate placement of the linear probe.*

Ultrasound gel is placed over a closed eyelid and the probe placed horizontally over the eyelid, applying as little pressure to the globe as possible. If available, Tegaderm or other thin covering (e.g., Latex glove) should be placed over a closed eyelid for further protection.

Figure 2 *An ultrasonographic view of a normal eye and optic nerve sheath.*

To measure ONSD, apply the ultrasound measuring device to the optic disc and measure back 3mm along the length of the optic nerve. A second, perpendicular measurement is obtained at the previously measured point that spans the horizontal width of the optic nerve sheath. In this image, ONSD was determined to be 5.1mm, a normal value.

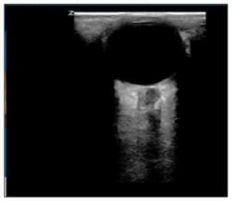


Figure 3. *Ultrasound image of the right optic nerve sheath of a 61-year-old man with a traumatic subdural hematoma.*

The optic nerve sheath measured 6.8mm in diameter. Elevated ICP was subsequently confirmed (26mmHg) after the placement of an ICP bolt monitor.

URGENCES 13-15 JUIN PARIS PORTE MAILLOT PALAIS DES CONGRÈS sfmu 2018

Echographie

Total blessés Pris en charge	Nombre blessés PEC par médecin	Nombre écho	Nombre EFAST	EFAST positifs	Autre (doppler membres repérage d'éclats)
310	228	190	171	39 (19%)	46

38% de modification de la gravité par rapport à l'évaluation clinique (aggrave dans 40%, minore 60%)

La clinique ne suffit pas toujours, l'échographie :

- *Confirme / infirme le niveau de gravité*
- *guide la prise en charge*

Mon 1er SSH 7,5% est fini, dois je remplir ?

- **Orientation clinique :**
  - ✓ Pouls radial présent ?
  - ✓ Epreuve de lever de jambes

- **Orientation échographique :** (hors VC)
  - ✓ Indices statiques :
    - *VCI < 10 mm = POD < 10 mm Hg*
    - VG hyperkinétique et exclusion systolique
  - ✓ Indices dynamiques :
    - ITV aortique
    - Distensibilité VCI
    - Compressibilité VCI

Service de santé des armées

Reevaluation / Resuscitation

Avec quel soluté ?

Ce qui n'est plus recommandé :

- Cristalloïdes isotonique ou hypotonique (RL)
- Colloïdes HEA
  - Acidose hyperchlorémique
  - Fuite exctravasculaire sur endothéliopathie
  - Hémodilution
  - Néphrotoxicité
  - HEA augmente mortalité

Aucune capacité de transport d'O2 !

Ce qui est plus toléré à minima mais n'apporte pas grand chose :

- ✓ Cristalloïdes hypertoniques

  moins de fuites extravasculaires
  atténueraient réponse inflammatoire
  sans EI en cas de TBI (contrôle PIC)

- ✓ Albumine 25%

  protéine plasma
  « endothélial friendly »

Tieu BH, Holcomb JB, Schreiber MA. Coagulopathy: its pathophysiology and treatment in the injured patient. World J Surg. 2007

David JS, Spann C, Marcotte G, et al. Haemorrhagic shock, therapeutic management. Ann Fr Anesth Reanim 2013

Service de santé des armées

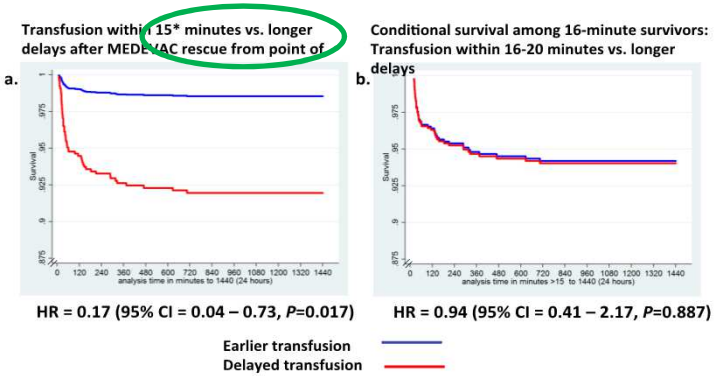
Reevaluation / Resuscitation

Avec quel soluté ?

✓ La transfusion préhospitalière *(militaire)* précoce est corrélé à un bénéfice en terme de survie

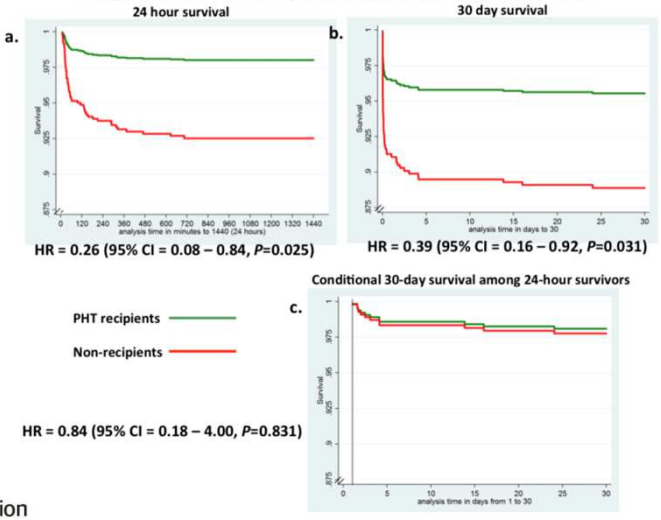
Early Transfusion, Pre- or In-Hospital

Adjusted Cox Proportional Hazards Models for 24 hour Survival



*Within a median of 36 minutes after injury occurrence (IQR 27,46)

Adjusted Cox Proportional Hazards Models



JAMA | Original Investigation

Association of Prehospital Blood Product Transfusion During Medical Evacuation of Combat Casualties in Afghanistan With Acute and 30-Day Survival

Stacy A. Shackelford, MD; Deborah J. del Junco, PhD; Nicole Powell-Dunford, MD; Edward L. Mazuchowski, MD, PhD; Jeffrey T. Howard, PhD; Russ S. Kotwal, MD, MPH; Jennifer Gurney, MD; Frank K. Butler Jr, MD; Kirby Gross, MD; Zsolt T. Stockinger, MD

✓ La transfusion préhospitalière diminue celle intrahospitalière

Rehn et al, Transfus Med. 2017

✓ Augmentation ratio de transfusion corrélé à augmentation survie ([OR] 8.6) et diminution mortalité à 6h

recommandations **ratio 1 RBC : 1 PLT : 1 Plasma**

Borgman et al.. J Trauma. 2007
PROMMT Study
Pidcoke HF et al. J Trauma Acute Care Surg. 2012

Service de santé des armées

Reevaluation / Resuscitation

Avec quel soluté ?

➢ PLASMA

✓ **PLYO / FLYP :** savoir-faire historique français

Sailliol A, Martinaud C, Cap AP, et al. The evolving role of lyophilized plasma in remote damage control resuscitation in the French Armed Forces Health Service. Transfusion 2013

REVIEW ARTICLE

S128 TRANSFUSION Volume 56, April 2016

Dried plasma: state of the science and recent developments

Anthony E. Pusateri,[1] Michael B. Given,[2] Martin A. Schreiber,[3] Philip C. Spinella,[4] Shibani Pati,[5] Rosemary A. Kozar,[6] Abdul Khan,[7] Joseph A. Dacorta,[8] Kevin R. Kupferer,[9] Nicolas Prat,[10] Heather F. Pidcoke,[11] Victor W. Macdonald,[12] Wilbur W. Malloy,[13] Anne Sailliol,[14] and Andrew P. Cap[11]

TABLE 2. Characteristics of commercially available dried plasmas

	FLYP	LyoPlas N-w	Bioplasma FDP
Use	1994-present—French Military 2011-present—Civilian (austere)	General population—Germany	General population—South Africa & neighboring countries
Processes	• Lyophilized • Pooled apheresis FFP <11 donors • All volunteer donors • Donor screening • Testing—disease & factors • Hemovigiliance program • 2003—Leukoreduced • 2010—No HLA Ab+ women • 2010—Amotosalen PR	• Lyophilized • 1990-2006: Pooled S/D • 2007-present—Single Donor • Donor screening • Hemovigilance Program • Frozen >/= 4 mos for donor retest • Leukoreduced • No HLA Ab+ women	• Lyophilized • Pooled (up to 1,500 donors) • All volunteer donors • Donor screening • Comprehensive testing • Hemovigilance program • S/D treatment for PR
Characteristics	• Normal factor levels • ABO-universal	• Normal factor levels • ABO type specific	• Factor levels: >/= 0.40 IU • ABO-universal plasma
Shelf-life	2 years at room temperature	15 months at 2°C-25°C	Store below 25°C
Reconstitution	<6 minutes	A few minutes	<10 minutes
Indication	As sole source of plasma where used	Same as frozen plasma	Where plasma and/or coagulation factors are required
Safety	No adverse events reported (including TRALI) since 1994 start of hemovigiliance program	• >300,000 U S/D LyoPlas • >230,000 U LyoPlas N-w (2007-2013) • Hemovigilance program reported no increase incidence of adverse events	Contraindicated: Severe Protein S deficiency • Hemovigilance program—no increase in adverse events
Efficacy	Clinical use reports support efficacy as part of a 1:1 DCR approach[12]	No restrictions related to clinical efficacy have been identified	No restrictions related to clinical efficacy have been identified

Table 1. Characteristics of plasma products

WILDERNESS & ENVIRONMENTAL MEDICINE, **28**, S124–S134 (2017)

TACTICAL COMBAT CASUALTY CARE: TRANSITIONING BATTLEFIELD LESSONS LEARNED TO OTHER AUSTERE ENVIRONMENTS

Remote Damage Control Resuscitation in Austere Environments

Product	*Fresh frozen plasma*	*Thawed plasma*	*Liquid plasma*	*French lyophilized plasma (French Red Cross)*
Source	Single donor	Single donor	Single donor	"Mini-pools" (≤10 donors), mixed ABO type
Pathogen inactivation	Screening only	Screening only	Screening only	Amotosalen ultraviolet light method
Storage	−18°C	1–6°C	1–6°C	Room temperature
Shelf life	1 year	5 days	Up to 40 days	2 years
Notes	Can be relabeled and stored as thawed plasma after thawing			ABO-universal

➢ PLAQUETTES ….. 14 j…. *Si lyophiolisée…?*

➢ CGR / RBC

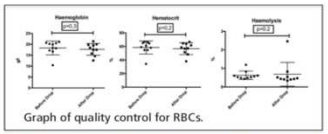
Boscarino C, Tien H, Acker J, et al. Feasibility and transport of packed red blood cells into Special Forces operational conditions. J Trauma Acute Care Surg 2014

Air-drop blood supply in the French Army

Olivier Javaudin,[1] A Baillon,[2] N Varin,[3] C Martinaud,[1] T Pouget,[1] C Civadier,[1] B Clavier,[1] A Sailliol[1]

BMJ Journals

Journal of the Royal Army Medical Corps



Graph of quality control for RBCs.

Slide Y. DANIEL

Service de santé des armées

Reevaluation / Resuscitation *Avec quel soluté ?*

Hemorrhagic blood failure: Oxygen debt, coagulopathy, and endothelial damage

J Trauma Acute Care Surg
Volume 82, Number 6, Supplement 1

Nathan J. White, MD, MS, Kevin R. Ward, MD, Shibani Pati, MD, PhD, Geir Strandenes, MD, *and* Andrew P. Cap, MD, PhD

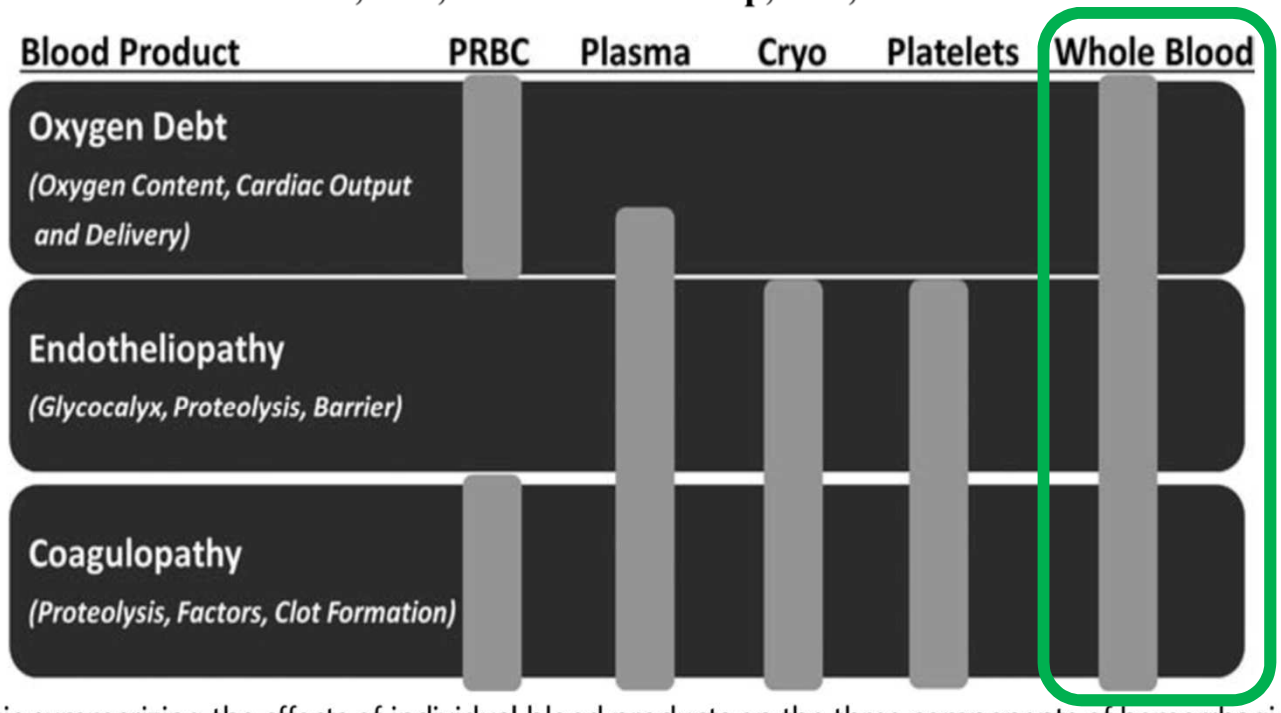


Figure 3. Schematic summarizing the effects of individual blood products on the three components of hemorrhagic blood failure. PRBC, packed red blood cells; Cryo, cryoprecipitate.

Service de santé des armées

Reevaluation / Resuscitation | *Avec quel soluté ?*

➢ SANG TOTAL / WB

✓ Le sang total serait plus efficace que la reconstitution des 3 composants

Table 2. Calculated parameters of fresh whole blood (450 mL donor blood with 63 mL anticoagulant) compared with component therapy with 1 unit packed red blood cells (hematocrit 55% in 335 mL), 1 unit fresh frozen plasma (80% coagulation factor activity, 250 mL), and 1 unit platelet (5.5×10^{10} platelets in 50 mL)

	Fresh whole blood	*1 to 1 to 1 component therapy*
Dilution factor	12%	35%
Hematocrit	33–43%	29%
Clotting factor activity	86%	65%
Platelets	130–350 × 10^9/L	88 × 10^9/L
Fibrinogen content	675–1800 mg	400–500 mg
Bags of product (donor exposure)	1	3–4

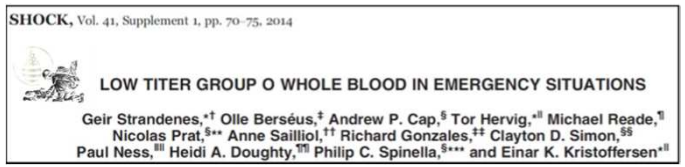
** Ponschab M,, et al. Haemostatic profile of reconstituted blood in a proposed 1:1:1 ratio of packed red blood cells, platelet concentrate and four different plasma preparations. Anaesthesia. 2015*

** Kornblith LZ, et al. The whole is greater than the sum of its parts: hemostatic profiles of whole blood variants. J Trauma Acute Care Surg. 2014*

✓ Conservation de 14j, perte activité plaquettaire, à 21 jours

Pidcoke et al. Transfusion 53:137S-149S, 2013

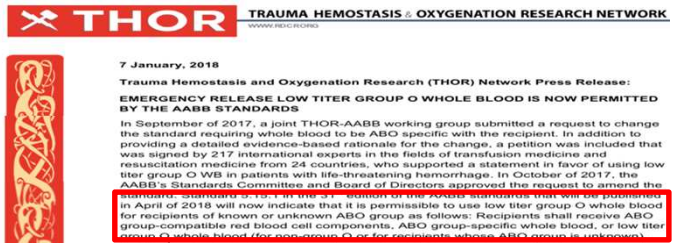
✓ Le recours aux O Low Titter (LTOWB) est possible si groupe inconnu



SHOCK, Vol. 41, Supplement 1, pp. 70–75, 2014

LOW TITER GROUP O WHOLE BLOOD IN EMERGENCY SITUATIONS

Geir Strandenes,*† Olle Berséus,‡ Andrew P. Cap,§ Tor Hervig,*‖ Michael Reade,¶ Nicolas Prat,§** Anne Sailliol,†† Richard Gonzales,‡‡ Clayton D. Simon,§§ Paul Ness,‖‖ Heidi A. Doughty,¶¶ Philip C. Spinella,§*** and Einar K. Kristoffersen*‖



THOR TRAUMA HEMOSTASIS & OXYGENATION RESEARCH NETWORK

7 January, 2018

Trauma Hemostasis and Oxygenation Research (THOR) Network Press Release:

EMERGENCY RELEASE LOW TITER GROUP O WHOLE BLOOD IS NOW PERMITTED BY THE AABB STANDARDS

In September of 2017, a joint THOR-AABB working group submitted a request to change the standard requiring whole blood to be ABO specific with the recipient. In addition to providing a detailed evidence-based rationale for the change, a petition was included that was signed by 217 international experts in the fields of transfusion medicine and resuscitation medicine from 24 countries, who supported a statement in favor of using low titer group O WB in patients with life-threatening hemorrhage. In October of 2017, the AABB's Standards Committee and Board of Directors approved the request to amend the standard. Standard 5.15.1 in the 31st edition of the AABB standards that will be published in April of 2018 will now indicate that it is permissible to use low titer group O whole blood for recipients of known or unknown ABO group as follows: Recipients shall receive ABO group-compatible red blood cell components. ABO group-specific whole blood, or low titer group O whole blood (for non-group O or for recipients whose ABO group is unknown)

✓ Transfusion Sang Total frais FWB en cas d'urgence : « BUDDY TRANSFUSION »

- *nécessite un screening préalable (armées)*
- *Avantage d'être déjà rechauffé*

SHOCK, Vol. 41, Supplement 1, pp. 76–83, 2014

EMERGENCY WHOLE-BLOOD USE IN THE FIELD: A SIMPLIFIED PROTOCOL FOR COLLECTION AND TRANSFUSION

Geir Strandenes,*† Marc De Pasquale,‡ Andrew P. Cap,§ Tor A. Hervig,† Einar K. Kristoffersen,† Matthew Hickey,‖ Christopher Cordova,¶ Olle Berseus,** Håkon S. Eliassen,† Logan Fisher,†† Steve Williams,‡‡ and Philip C. Spinella§,§§

Reevaluation / Resuscitation

Quels objectifs ?

Stratégie limitée en RDCR

➢HYPOTENSION PERMISSIVE

- ✓Le remplissage agressif excessif est source de morbimortalités
- ✓Pas d'étude prouvant bénéfice de l'hypotension permissive : concept philosophique admis
- ✓Effet secondaire sur dette en oxygène et le pronostic rénal

Duke et al, Restrictive fluid resuscitation in combination with damage control resuscitation: time for adaptation. J Trauma Acute Care Surg. 2012

THOR 2018

J Trauma Acute Care Surg
Volume 84, Number 6, Supplement 1

Trauma Hemostasis and Oxygenation Research Network position paper on the role of hypotensive resuscitation as part of remote damage control resuscitation

"Novel Hybrid Resuscitation" : en situation isolée ou prolongée, maintien d'objectifs tensionnels :

- ✓ PAS entre 90 et 110mmHg la 1ère heure (traumatisé hémorragique)
- ✓ Réévaluer risque hémorragique à l'issue de la 1ère heure pour objectifs normotensionnels
- ✓ PAS > 110mmHg pour TBI
- ✓ **SANG TOTAL !!!**

Reevaluation / Resuscitation

Procoagulants ?

✓ **Acide Tranexamique TXA (antifibrinolytique)**

1g le plus tôt possible durant les 3 premières heures

2ème dose dans les 6h

2018 WTA Podium Paper

J Trauma Acute Care Surg
Volume 85, Number 5

Severely injured trauma patients with admission hyperfibrinolysis: Is there a role of tranexamic acid? Findings from the PROPPR trial

Muhammad Khan, MD, Faisal Jehan, MD, Eileen M. Bulger, MD, Terence O'Keeffe, MD, John B. Holcomb, MD, Charles E. Wade, PhD, Martin A. Schreiber, MD, Bellal Joseph, MD, *and* on behalf of the PROPPR Study Group, *Tucson, Arizona*

- 3-8% traumatisés ont une hyperfibrinolyse sévère, 60% modérée
- Littérature contradictoire pour effet sur mortalité en utilisation empirique (pas de monitorage fibrinolyse)
- Association possible Transfusion préhosp – TXA - Survie à 6h voire à 24h (impact prévalence TBI après 6h ?)
- Pas de complication thrombotiques

Wafaisade A, et al. Prehospital administration of tranexamic acid in trauma patients. Crit Care. 2016

J Trauma Acute Care Surg
Volume 84, Number 6, Supplement 1

Tranexamic acid in severe trauma patients managed in a mature trauma care system

Boutonnet et al.

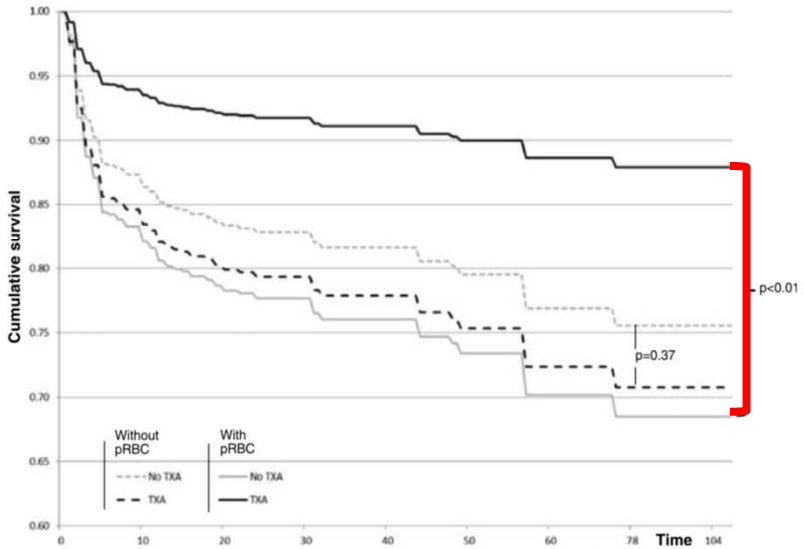


Figure 3. Kaplan-Meier survival curves of patients receiving or not pRBC in ER (Log rank test) (n = 684). Time is expressed in days.

Service de santé des armées

Reevaluation / Resuscitation

Procoagulants ?

✓ **Fibrinogène**

2,4 g présent dans PLYO/FLYP…..
pas de bénéfice prouvé sans dosage

o **R-Facteur VIIa**

- Recommandé FDA pour traitement hémophilies
- Conservation au froid
- Onéreux
- Littérature insuffisante :
  - Possible intérêt dans trauma fermé *Boffard et al. 2005*
  - Pas d'intérêt dans trauma pénétrant

Service de santé des armées

Reevaluation / Resuscitation

Amines ?

✓ **Noradrénaline IVSE :**
Précocement selon guidelines

TTT associés

✓ **Calcium**
2g de CaCl ou 4g de Gluconate de Ca2+ dès 1ère transfusion

- Prévalence Hypocalcémie chez traumatisé : 97,4%
- 50-70% sévères (<0,8 mmol/L) *Giancarreli, J Surg Res, 2016*
- Aggrave coagulopathie

o **Bicarbonate de Sodium**

- Pas d'étude montrant l'avantage dans lutte contre acidose du traumatisé

- Préférer TTT de l'hypoperfusion et de l'hypoxie tissulaire

Service de santé des armées

Reduce Tourniquet

1ère réevaluation 2h après sa pose

- *Pas de complications documentées avant 150min*
- *>6h : risque reperfusion > maintien*

PROLONGED FIELD CARE Journal of Special Operations Medicine Volume 15, Edition 3/Fall 2015

Tourniquet Conversion

A Recommended Approach in the Prolonged Field Care Setting

Brendon Drew, DO; David Bird, PA-C, MPAS; Michael Matteucci, MD; Sean Keenan, MD

Contre indications :

- ✓Ctxt tactique non maitrisé
- ✓Amputation
- ✓Choc : pouls radial absent, blessé inconscient
- ✓Garrot mis en place > 4h
- ✓Chirurgien à moins de 1h de délai
- ✓Surveillance du blessé impossible & remise d'un garrot non possible
- ✓Relai par pst hemostatique et compressif impossible

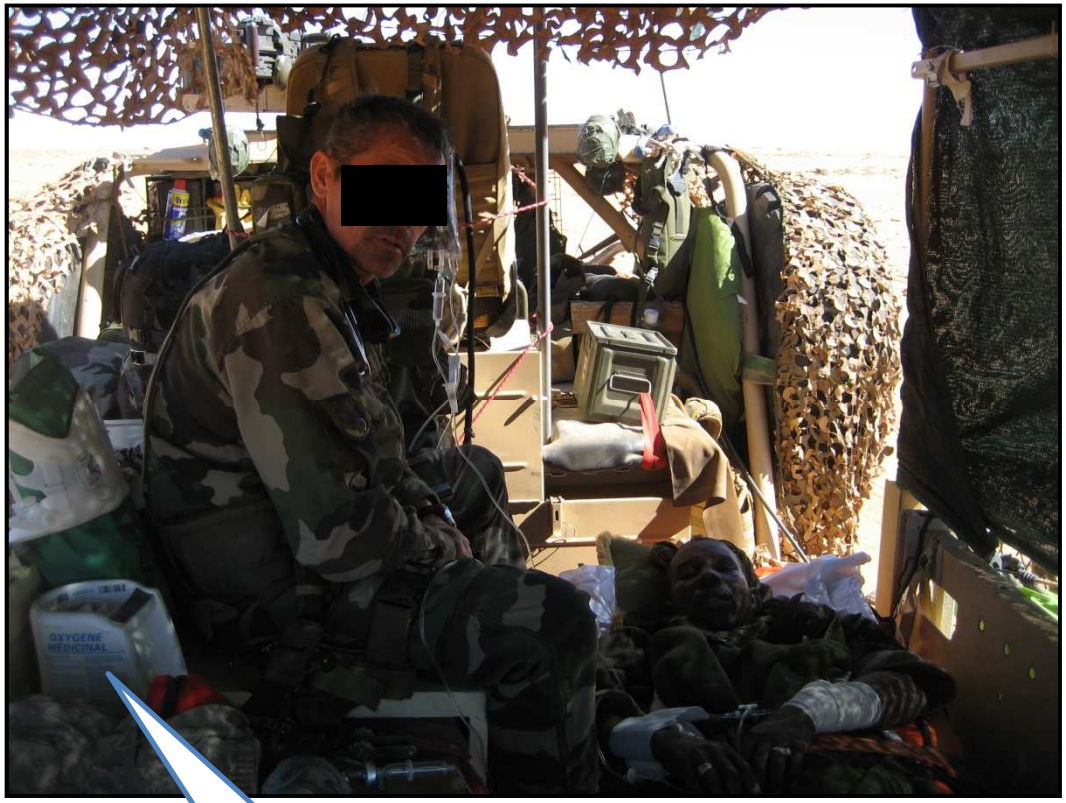
CAT :

- ✓ Mettre en place un garrot attente supplémentaire
- ✓ Retrait progressif garrot et mep relai par pansement Hémostatique + Compressif
- ✓ Garrot attente laissé en place
- ✓ Surveillance rapprochée

Service de santé des armées

Airways **Ventilate / Oxygenate**

C'est la logistique qui parle !



1-2 obus de 3L…..

Service de santé des armées

Ventilate / Oxygenate

✓ **INTUBATION :** réserver ses indications

- Contrainte logistique majeure
- Respirateur Air Ambiant (Save II)
- Bouteille O2 surcompressé
- Ventilation protectrice avec **PEP** & **Vt 6-7 mL/Kg** en utilisant le **Poids Idéal Théorique**

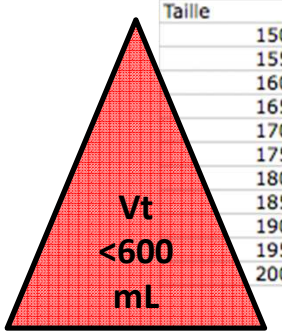
Airway and ventilation management strategies for hemorrhagic shock. To tube, or not to tube, that is the question!

J Trauma Acute Care Surg
Volume 84, Number 6, Supplement 1

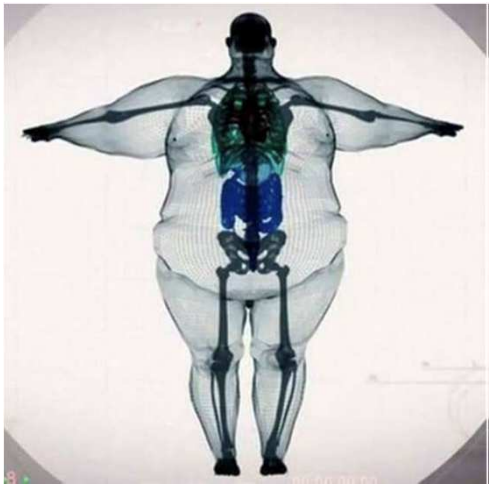
Anthony J. Hudson, MA, Geir Strandenes, MD, Christopher K. Bjerkvig, MD, Marius Svanevik, MD, *and* **Elon Glassberg, MD, MHA**, *Devon, UK*

TABLE 1. Potential Pitfalls of Drug-Assisted Intubation and Positive Pressure Ventilation in Hemorrhagic Shock

Intervention	Potential Adverse Effect
Neuromuscular blocking agents	Apnea, hypoxemia, respiratory acidosis
Sedation agents	Hypotension, respiratory depression, hypoxemia
Intubation attempts	Hypoxemia, unrecognized oesophageal placement of endotracheal tube
Positive pressure ventilation	Reduced cardiac output, hypothermia,
Inadvertent hyperventilation	Cerebral vasoconstriction



Taille	PIT	Vt 6 ml/kg PIT	Vt 7 ml/kg PIT
150	50	300	350
155	53,75	323	376
160	57,5	345	403
165	61,25	368	429
170	65	390	455
175	68,75	413	481
180	72,5	435	508
185	76,25	458	534
190	80	480	560
195	83,75	503	586
200	87,5	525	613



Service de santé des armées

Initiate telemedecine & Evacuation

Service de santé des armées

Nursing / Monitoring

- ✓ Sondage Urinaire et Diurèse
- ✓ SNG
- ✓ Aspiration trachéale
- ✓ Changement régulier de positions
- ✓ Massage prophylactique points d'appui
- ✓ Latéralisation pour éviter SDRA
- ✓ Hygiène orale
- ✓ Occlusion palpébrale
- ✓ Nutrition
- ✓ Hydratation
- ✓ Antalgie

Place des infirmiers ?

➢ ***MONITORING :***

- ✓ ***Clinique***
- ✓ ***Echographique***
- ✓ ***Biologique***

Monitorage Dette Oxygène et SaO2 tissulaire :

Lactates, BE, (POC labo embarqué)…

Management of Burn Wounds Under Prolonged Field Care

Journal of Special Operations Medicine Volume 16, Edition 4/Winter 2016

Leopoldo C. Cancio, MD; Doug Powell, MD; Britton Adams, NREMT-P, ATP; Kenneth Bull, MD; Alexander Keller, MD; Jennifer Gurney, MD; Jeremy Pamplin, MD; Stacy Shackelford, MD; Sean Keenan, MD

- **Minimum: rectal infusion of electrolyte solution**
  - Rectal infusion of up to 500mL/h can be supplemented with oral hydration (see Hydration box below)

URGENCES 13-15 JUIN PARIS PORTE MAILLOT PALAIS DES CONGRÈS sfmu 2018

Service de santé des armées

Environmental considerations

- ✓ **Hypo/Hyperthermia :**

  Solutés frais à réchauffer

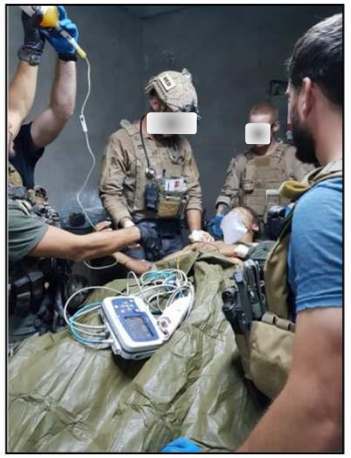
  Techniques passives : limite la baisse

  Techniques actives *+1,8°/h* : couvertures rechauffantes

  Soluté réchauffé *(appareil, plaque moteur, bain-marie, ration,…)*

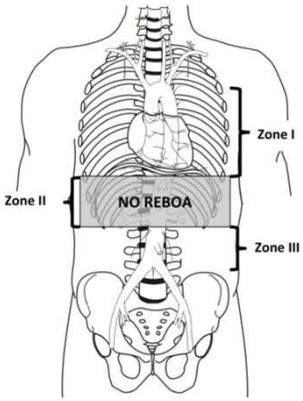
- ✓ **Protection oreille, oculaire, lumineuse**

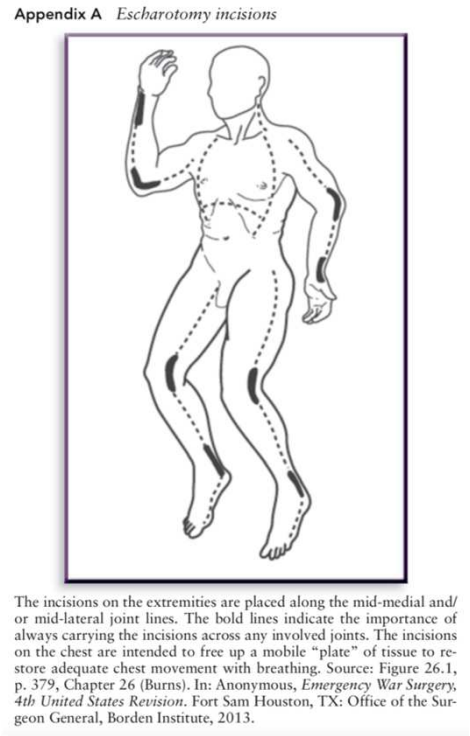
- ✓ **Prévention mal transports**



Surgical procedures

- **Gestes chirurgicaux à faire sur le terrain,** *si pas déjà fait*
  - ✓ *Crycothyrhoïdie*
  - ✓ *Thoracotomie de ressuscitation*
  - ✓ *Régularisation d'amputation*
  - ✓ *Débridement*
  - ✓ *Retrait de CE*
  - ✓ *Fasciotomie*
  - ✓ *REBOA*




Appendix A *Escharotomy incisions*

The incisions on the extremities are placed along the mid-medial and/or mid-lateral joint lines. The bold lines indicate the importance of always carrying the incisions across any involved joints. The incisions on the chest are intended to free up a mobile "plate" of tissue to restore adequate chest movement with breathing. Source: Figure 26.1, p. 379, Chapter 26 (Burns). In: Anonymous, *Emergency War Surgery, 4th United States Revision*. Fort Sam Houston, TX: Office of the Surgeon General, Borden Institute, 2013.

Service de santé des armées

CONCLUSION

- RDCR et PFC sont tournés **contre la triade létale à travers**

- Les **techniques et principes du DCR** mais **pragmatiques** et guidés par **les impératifs du terrain**

- **Formation indispensable + entretien des compétences**
  - des primo-intervenants
  - des médecins qui doivent faire de la réanimation pré-hospitalière

- **Sujets prospectifs majeurs :**
  - **transfusion** précoce *vs* défi logistique induit
  - télémédecine et aide à la décision : y a t-il véritablement un sujet sur le R-DCR ?
  - apporter de **l'oxygène** *vs* réduire l'empreinte logistique et les gaspillages
  - des médecins **au bon endroit** pour sauver des vies au bon moment
  - comment **valoriser les délais d'évacuation**
    - → *In flight Damage Control R + S*
    - → grignoter dans le champ de compétence du chirurgien vs la chasse gardée

Service de santé des armées

REMOTE DAMAGE CONTROL RESUSCITATION IN AUSTERE ENVIRONMENTS
&
PROLONGED FIELD CARE

Questions ?

04/12/2018

Dr MORAND[1] - Dr ZELLER[2]

1. *1ière CSS-FS/4ème Antenne Médicale Spécialisée*
2. *Commandement des Opérations Spéciales*