



Intro to THOR and RDCR

Spinella and Strandenes



The THOR Network

- **An international multidisciplinary network of civilian and military providers ranging from first responders and medics to critical care physicians and from basic scientists to clinical trialists.**
- **VISION: To improve outcomes from traumatic hemorrhagic shock by optimizing the acute phase of resuscitation.**



The THOR Network

- **MISSION:** To develop and implement best practices for prehospital care through to the completion of the acute phase of hemorrhagic shock resuscitation.
- The THOR Network will execute this mission through a multidisciplinary collaborative approach to research, education, training, and advocacy.



THOR Network Origin

- 2010 email: Strandenes to Spinella to Chair Scientific Steering Committee
- 2011 meeting in Innsbruck Austria
 - Epiphany at Limerick Bill's Irish bar.
 - Start yearly conference with international experts on trauma resuscitation to expedite knowledge transfer and change practice.
- June 2011 first meeting in Bergen
- June 2012-present meetings at Solstrand



THOR Balance

- Civilian and Military
- North American and Europe
- Practitioner and Scientists
- Clinical disciplines
 - multi-disciplinary
- Major key to success of Network



THOR Structure

- Steering Committee of 13
 - Strandenes, Spinella, Jenkins, Glassberg
 - Keenan, Woolley, Doughty, Yazer, Cap
 - Ward, Thompson, DePasquale, Elliason
- Members
 - You are all members



Remote Damage Control Resuscitation

G

- Prehospital application of Damage Control Resuscitation (DCR) principles
- Goals are the same RDCR and DCR
- How you achieve it differs between RDCR and DCR
 - Austere environment
 - Airway management
 - Monitoring capabilities
 - Therapeutic options



Blood transfusion management in the severely bleeding military patient

Curr Opin Anesthesiol 2018, 31:000–000

DOI:10.1097/ACO.0000000000000574

Jennifer M. Gurney^{a,b} and Philip C. Spinella^{b,c}

Table 1. Damage control resuscitation principles

Pre-hospital

Rapid recognition of life-threatening hemorrhagic shock

Point-of-care devices: near infrared spectroscopy; INR; lactate level may be of value

Prevent hypothermia

Hemorrhage control with mechanical hemostatic adjuncts:

Tourniquet/junctional tourniquet

Pressure dressings/thrombin and fibrin-impregnated gauze

REBOA

Intraabdominal foams (investigational)

Hemostatic resuscitation

Whole blood is optimal

Component therapy with plasma (dried, liquid, or thawed), RBCs, and platelets in 1 : 1 : 1 ratio

Permissive hypotension for patients without traumatic brain injury^a

Avoid crystalloid resuscitation

Consider TXA administration if less than 3 h from time of injury^b

Consider source of fibrinogen (fibrinogen concentrate or cryoprecipitate)

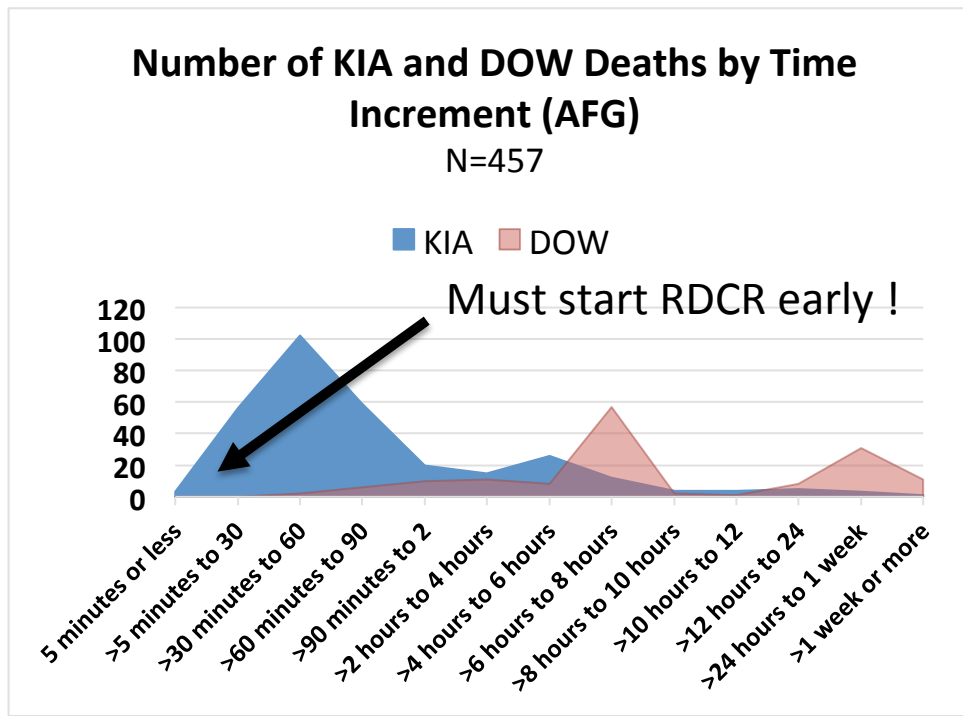
Avoid hypocalcemia

In prolonged evacuations, empiric calcium administration for every 4–6 units of RBCs or WB



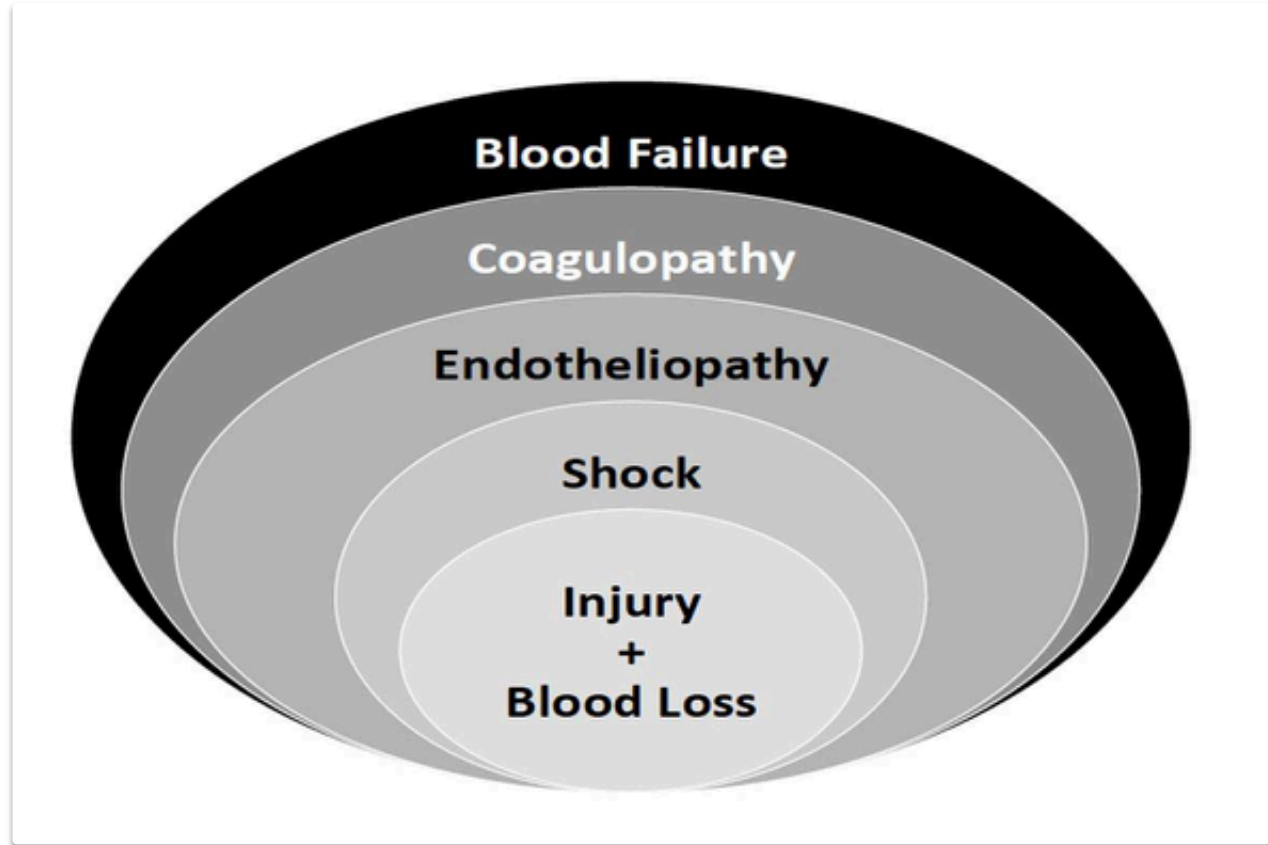
Why focus on prehospital ?

- Where vast majority of deaths occur
 - Preventable deaths
 - Military and Civilian
- Hemorrhagic deaths occur fast





RDCR Principles - Blood Failure





RDCR Principles – Blood Failure

- Blood is an organ and can fail like any other organ
- Balanced/simultaneous treatment of shock, hemostatic and endothelial dysfunction prevents the exacerbation of one aspect of blood function
- Term emphasizes the interaction between blood systems
 - Promote a balanced approach to resuscitation



RDCR Principles – Blood Based Resuscitation

BENEFITS OF LOW TITER GROUP O WHOLE BLOOD FOR HEMORRHAGIC SHOCK

- Efficacy
 - The cold stored platelets provide **improved hemostasis** compared to room temperature platelets
 - Whole blood is a **more concentrated** product that contains a small quantity of anticoagulant and additive solution than an equal amount of conventional components
- Safety
 - Reduced risk of hemolysis from the **low titer** minor incompatible plasma compared to the risk from untitered minor incompatible plasma or platelets
 - **Reduced risk of bacterial contamination** compared to room temperature stored platelets
 - **Long-standing safety record** with over 1 million units transfused in combat and civilian settings
- Logistic
 - **Increased access to platelets** for both pre-hospital and early in-hospital resuscitations
 - **Simplifies the logistics of the resuscitation** and accelerates the provision of all blood components needed to treat hemorrhagic shock



Permissive Airway Management

- Positive Pressure Ventilation and Intubation can cause hypotension or cardiac arrest for patient with severe hemorrhage if hypovolemia not corrected prior to intubation
- Reserve intubation for inability to maintain airway or hypoxemia



DONT DISCONNECT THE HEART LUNG MACHINE
PRIOR TO SURGERY: KEEP THE BLEEDING PATIENT SPONTANEOUS BREATHING IF POSSIBLE



RDCR Principles - Rational Risk Assessment

- Assessment of risk proportional to potential benefit
 - Incompatible plasma
 - Cold platelets
 - Prehospital blood transfusion



LOW TITER GROUP O WHOLE BLOOD IN EMERGENCY SITUATIONS

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ABSTRACT—In past and ongoing military conflicts, the use of whole blood (WB) as a resuscitative product to treat trauma-induced shock and coagulopathy has been widely accepted as an alternative when availability of a balanced component-based transfusion strategy is restricted or lacking. In previous military conflicts, ABO group O blood from donors with low titers of anti-A/B blood group antibodies was favored. Now, several policies demand the exclusive use of ABO group-specific WB. In this short review, we argue that the overall risks, dangers, and consequences of “the ABO group-specific approach,” in emergencies, make the use of universal group O WB from donors with low titers of anti-A/B safer. Generally, risks with ABO group-specific transfusions are associated with *in vivo* destruction of the red blood cells transfused. The risk with group O WB is from the plasma transfused to ABO-incompatible patients. In the civilian setting, the risk of clinical hemolytic transfusion reactions (HTRs) due to ABO group-specific red blood cell transfusions is relatively low (approximately 1:80,000), but the consequences are frequently severe. Civilian risk of HTRs due to plasma incompatible transfusions, using titered donors, is approximately 1:120,000 but usually of mild to moderate severity. Emergency settings are often chaotic and resource limited, factors well known to increase the potential for human errors. Using ABO group-specific WB in emergencies may delay treatment because of needed ABO typing, increase the risk of clinical HTRs, and increase the severity of these reactions as well as increase the danger of underresuscitation due to lack of some ABO groups. When the clinical decision has been made to transfuse WB in patients with life-threatening hemorrhagic shock, we recommend the use of group O WB from donors with low anti-A/B titers when logistical constraints preclude the rapid availability of ABO group-specific WB and reliable group matching between donor and recipient is not feasible.

KEYWORDS—Whole blood, ABO- titers, universal blood, blood transfusion, damage control resuscitation



Major accomplishments

- Symposium Supplements
- DCR/RDCR Textbook

TRANSFUSION

Viking Laces

- 1. A special issue celebrating the 100th anniversary of the American Association for the Surgery of Trauma (AAST) and the 100th anniversary of the American Association of Blood Banks (AABB).
- 2. A special issue celebrating the 100th anniversary of the American Association of Blood Banks (AABB).
- 3. A special issue celebrating the 100th anniversary of the American Association of Blood Banks (AABB).
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- 10. A special issue celebrating the 100th anniversary of the American Association of Blood Banks (AABB).



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The THOR Network 2012 Remote Damage Control Resuscitation Symposium

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June 17-18, 2013

CEEST EDITORS: Marc Warzecky and Kevin R. Ward
EDITOR: Amgar Avner

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Remote Damage Control Resuscitation Symposium

FORWARD TO THE PAST AND THE FUTURE

1914 "The value of packed red cells compared to fresh whole blood transfusion. Results obtained after infusion with physiologic buffers. Whole blood is more readily available."
J Trauma 1914; 54: 1000-1005

1963 "Blood shock is reversible, and should be treated with blood."
J Trauma 1963; 13: 100-105

1965 "Transfusion does not get whole blood to the patient."
J Trauma 1965; 5: 100-105

1966 "Normal human physiology indicates a need for red cell mass to be 100% of body weight."
J Trauma 1966; 6: 100-105

1968 "These patients who undergo shock resuscitation in a matter of minutes should not be treated with fresh whole blood."
J Trauma 1968; 8: 100-105

The decision to transfuse blood is based upon the patient's response to initial fluid resuscitation and the unique profile of organ perfusion. Remote Damage Control Resuscitation (ROCC)

2014 "The decision to transfuse blood is based upon the patient's response to initial fluid resuscitation and the unique profile of organ perfusion. Remote Damage Control Resuscitation (ROCC)

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TRANSFUSION



GLOBAL PREHOSPITAL CARE
ROOTED IN A HISTORY OF
MILITARY INNOVATION



A Supplement to TRANSFUSION
The 2013 Remote Damage Control Resuscitation Symposium
100 Year Anniversary Edition

Guest Editors:
Shiloh Patel, MD, PhD
Philip C. Spinella, MD, FCCR



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Damage Control Resuscitation Symposium



FRANK BUTLER'S LAWS

1. The patient who is injured is not a patient until they are in the hospital.
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Proceedings from the THOR Network's 2017 Remote
Damage Control Resuscitation Symposium

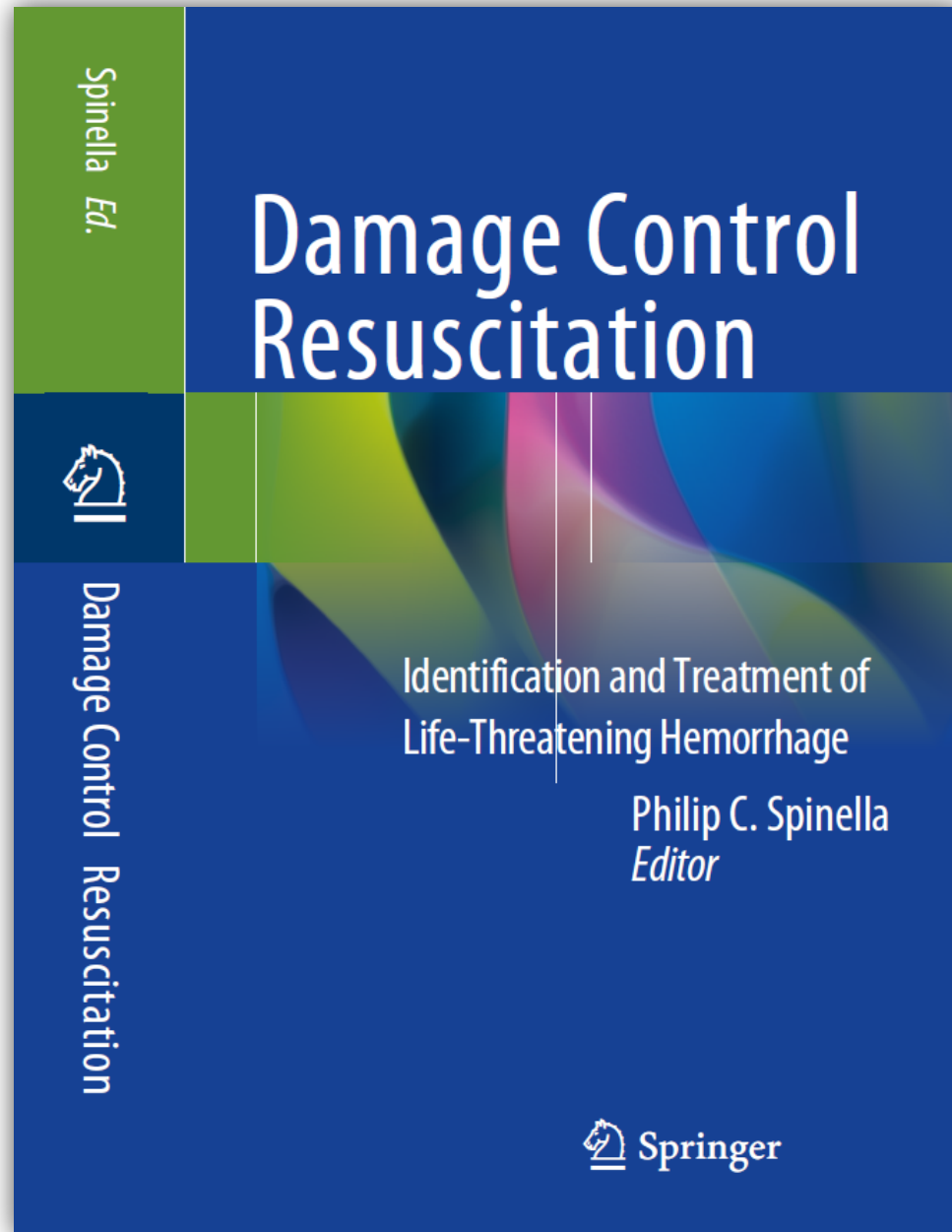
EMERGENCY RELEASE LOW TITER GROUP O WHOLE BLOOD IS NOW PERMITTED BY THE AABB STANDARDS

Standard 1.1.1.1 (1.1.1.1) of the AABB standards for blood banks and transfusion services states that "Group O whole blood is not permitted for transfusion to patients with RhD positive blood type." This standard was revised to allow for the use of low titer group O whole blood in emergency situations.



The AABB states that the standard for low titer group O whole blood is now permitted for transfusion to patients with RhD positive blood type. This standard was revised to allow for the use of low titer group O whole blood in emergency situations.

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Major accomplishments

- Position papers



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

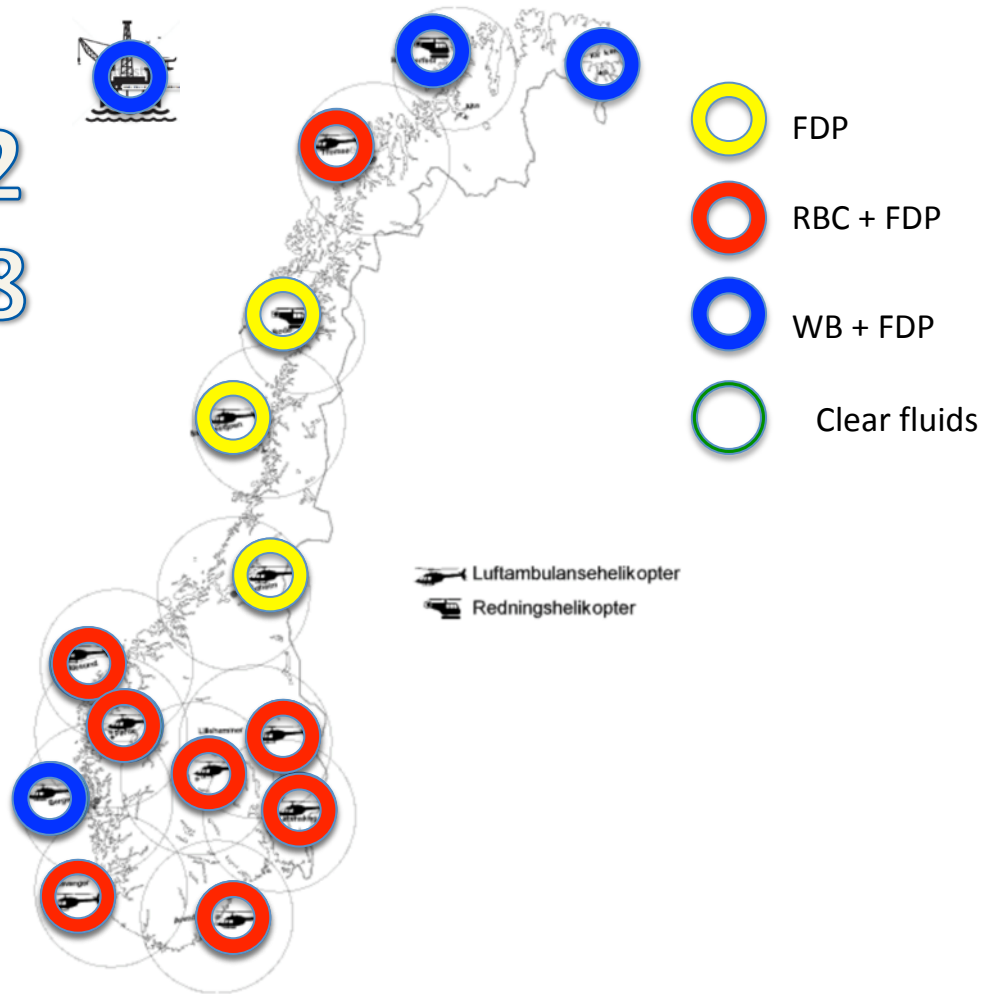
Thomas Woolley, MD, Patrick Thompson, Emrys Kirkman, PhD, Richard Reed, Sylvain Ausset, MD, Andrew Beckett, MD, Christopher Bjerkgvig, MD, Andrew P. Cap, MD, PhD, Tim Coats, MD, Mitchell Cohen, MD, Marc Despasquale, Warren Dorlac, MD, Heidi Doughty, Richard Dutton, MD, Brian Eastridge, Elon Glassberg, MD, Anthony Hudson, Donald Jenkins, MD, Sean Keenan, MD, Christophe Martinaud, PhD, Ethan Miles, Ernest Moore, MD, Giles Nordmann, Nicolas Prat, PhD, Joseph Rappold, MD, Michael C. Reade, MBBCh, Paul Rees, MD, Rory Rickard, PhD, Martin Schreiber, MD, Stacy Shackelford, MD, Håkon Skogran Eliassen, Jason Smith, MD, Mike Smith, PhD, Philip Spinella, MD, Geir Strandenes, MD, Kevin Ward, MD, Sarah Watts, PhD, Nathan White, MD, and Steve Williams, Birmingham, United Kingdom

ABSTRACT: The Trauma Hemostasis and Oxygenation Research (THOR) Network has developed a consensus statement on the role of permissive hypotension in remote damage control resuscitation (RDCR). A summary of the evidence on permissive hypotension follows the THOR Network position on the topic. In RDCR, the burden of time in the care of the patients suffering from noncompressible hemorrhage affects outcomes. Despite the lack of published evidence, and based on clinical experience and expertise, it is the THOR Network's opinion that the increase in prehospital time leads to an increased burden of shock, which poses a greater risk to the patient than the risk of rebleeding due to slightly increased blood pressure, especially when blood products are available as part of prehospital resuscitation. The THOR Network's consensus statement is, "In a casualty with life-threatening hemorrhage, shock should be reversed as soon as possible using a blood-based HR fluid. Whole blood is preferred to blood components. As a part of this HR, the initial systolic blood pressure target should be 100 mm Hg. In RDCR, it is vital for higher echelon care providers to receive a casualty with sufficient physiologic reserve to survive definitive surgical hemostasis and aggressive resuscitation. The combined use of blood-based resuscitation and limiting systolic blood pressure is believed to be effective in promoting hemostasis and reversing shock" (*J Trauma Acute Care Surg.* 2018;84: S3-S13. Copyright © 2018 Wolters Kluwer Health, Inc. All rights reserved.)

NORWAY



2012
2018



Norwegian Armed Forces CPG for –RDCR

- TCCC implementation throughout the Force- All units with the operational need for resuscitation of hemorrhagic shock should have blood products available as close to point of injury as possible. Group 0 low titer cold stored as preferred fluid of choice. Crystalloids and Colloids is not to be used for resuscitation of life threatening hemorrhagic shock- Both in hospital and prehospital.
- Minimum is plasma.

Norwegian Armed Forces CPG Role 1
Sessvollmoen den 27. 01.2017

- DCR with whole blood.
- Walking donor pool capability
- All soldiers considered to be a donor



Norway RDCR

- No longer a question that blood should be available as Far Forward as possible
- The Challenge is:
- **EDUCATION AND TRAINING**



Major accomplishments

- Change in practice/policies
 - Military and Civilian
 - Clinical practice guidelines and protocols



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

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Håkon S. Eliassen,[†] Logan Fisher,^{††} Steve Williams,^{‡‡} and Philip C. Spinella^{§,§§}**

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Received 19 Sep 2013; first review completed 8 Oct 2013; accepted in final form 10 Dec 2013

ABSTRACT—Military experience and recent *in vitro* laboratory data provide a biological rationale for whole-blood use in the treatment of exsanguinating hemorrhage and have renewed interest in the reintroduction of fresh whole blood and cold-stored whole blood to patient care in austere environments. There is scant evidence to support, in a field environment, that a whole blood–based resuscitation strategy is superior to a crystalloid/colloid approach even when augmented by a limited number of red blood cell (RBC) and plasma units. Recent retrospective evidence suggests that, in this setting, resuscitation with a full complement of RBCs, plasma, and platelets may offer an advantage, especially under conditions where evacuation is delayed. No current evacuation system, military or civilian, is capable of providing RBC, plasma, and platelet units in a prehospital environment, especially in austere settings. As a result, for the vast minority of casualties, in austere settings, with life-threatening hemorrhage, it is appropriate to consider a whole blood–based resuscitation approach to provide a balanced response to altered hemostasis and oxygen debt, with the goal of reducing the risk of death from hemorrhagic shock. To optimize the successful use of fresh whole blood/cold-stored whole blood in combat field environments, proper planning and frequent training to maximize efficiency and safety will be required. Combat medics will need proper protocol-based guidance and education if whole-blood collection and transfusion are to be successfully and safely performed in austere environments. In this article, we present the Norwegian Naval Special Operation Commando unit–specific remote damage control resuscitation protocol, which includes field collection and transfusion of whole blood. This protocol can serve as a template for others to use and adjust for their own military or civilian unit–specific needs and capabilities for care in austere environments.

KEYWORDS—Shock, prehospital, remote, damage control, trauma, combat



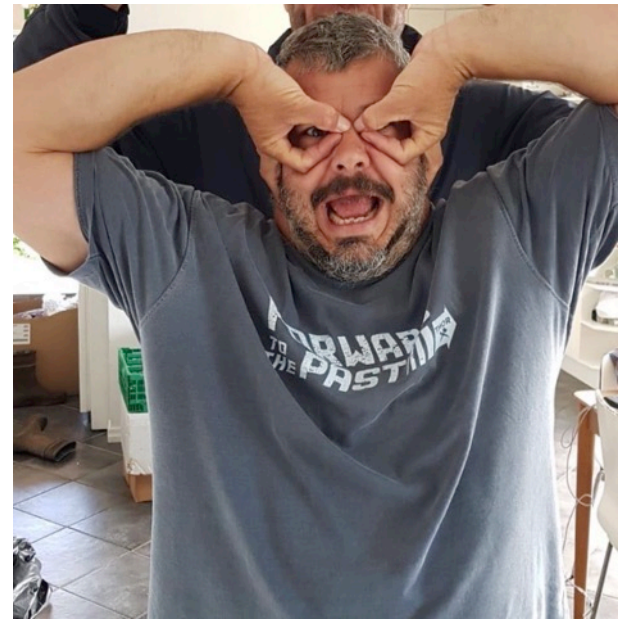
Major accomplishments

- AABB change in whole blood standards
- Research
- Education and Training tools



RDCR Conference Goals

- Foster unique collaborations
 - Doughty and Thompson
 - (if the Queen only knew!)





THOR Network RDCR Conference^G Goals

- Preconference Training Exercises
 - NORNAVSOC
- Share needs and knowledge
- Innovate
- Have fun



THOR Future Directions

- Strategic planning meeting after conference
- Consideration of
 - Development of working groups to address specific issues
- THOR ROADTRIPS
 - AABB
 - US Military Medical School (USUHS)
 - Italian Army
 - Swiss HEMS



Questions?