ÚSTŘEDNÍ VOJENSKÁ NEMOCNICE
Vojenská fakultní nemocnice
Praha

RDCR
and
Blood Far Forward Concept
as a New Chalenge

COL.Miloš Bohoněk, MD, PhD

12th.Střešovice Blood Transfusion Day

Whole Blood Is Coming Back !

Prague, November 15th, 2018

RDCR

= Remote Damage Control Resuscitacion

What it means?

RDCR

Damage Control

Originated in the US Navy (1943), refers to the capacity of a ship to absorb damage and maintain mission integrity

- **Save the ship!**
- **Fix the pipe!**

RDCR

Damage Control

Originated in the US Navy (1943), refers to the capacity of a ship to absorb damage and maintain mission integrity

Goals:

- **Damage inventory**
- **Save lives**
- **Keeping the ship afloat**

DCS

Damage Control Surgery

= Surgical strategy to cope with the lethal triad of death (acidosis, hypothermia, and coagulopathy)**, often seen in severely injured patients.**

The concept of bail-out surgery and reoperation was introduced during the 1980s as a treatment modality for severe abdominal trauma (issued from good results of perihepatic packing in 1970s)

This strategy of trauma care was named "damage control surgery" by Rotondo et al in 1993:

- initial laparotomy
- secondary resuscitation
- definitive surgery.

Kobayeashi K., Damage control surgery-a historical view, Nihon Geda Dakkai Zasshi, 2002 Jul;103(7):500-2.

RDCR

Damage Control Resuscitation

= the natural evolution of the initial concept of damage control surgery.

Includes :

- early blood product transfusion,
- immediate arrest and/or temporization of ongoing hemorrhage (i.e., temporary intravascular shunts and/or balloon tamponade)
- restoration of blood volume and physiologic/hematologic stability.
- as a result, DCR addresses the early coagulopathy of trauma, avoids massive crystalloid resuscitation and leaves the peritoneal cavity open when a patient approaches physiologic exhaustion without improvement.

The concept also applies to severe injuries within anatomical transition zones as well as extremities.

Ball CG, Damage control resuscitation: history, theory and technique., Can J Surg. 2014 Feb;57(1):55-60.

RDCR

Damage Control Resuscitation in battelfied

DCR adreses the entire lethal triad immediately upon admission to a combat hospital

Holcomb JB et all, Damage control resuscitation: directly addressing the early coagulopathy of trauma. J Trauma, 2007 Feb;62(2):307-10.

Trauma DC

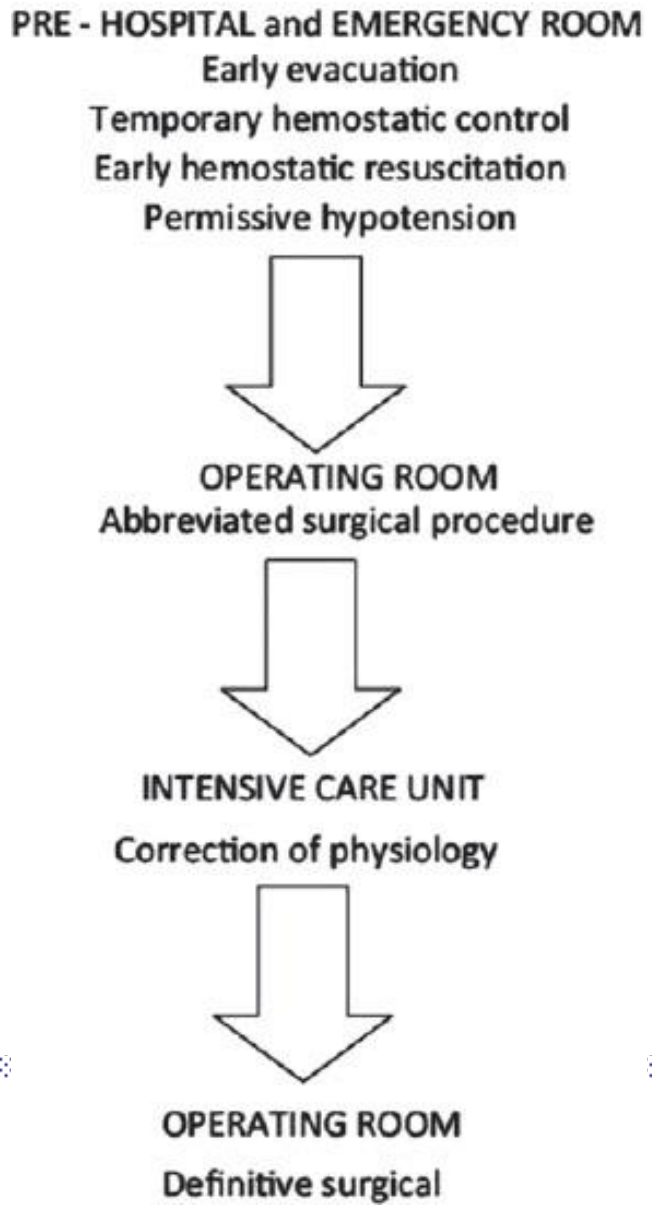
= **a strategy for management of injured patients that includes DCS and DCR**

DC surgery is most often used to control exsanguinating hemorrhage

After operation, the patient is admitted to ICU for ongoing resuscitation before undergoing additional surgery.

Roberts JD et all, History of the Innovation of Damage Control for Management of Trauma Patients: 1902–2016 ., Virginia Commonwealth University VCU Scholars Compass Surgery Publications Dept. of Surgery, 2017

Trauma DC



Chatrath V., Khetarpal R., Ahuja J.,
Fluid management in patients with trauma:
Restrictive versus liberal approach, J.of Anest.,
Clin.Pharm., 2015; 31/3: 308-316

Trauma DC

DC resuscitation is a new concept characterized by **rapid hemorrhage control**, permissive hypotension, **administration of blood products in a ratio approximating whole blood,** and **minimal use of crystalloid fluids**.

DC is an important development in trauma care and surgery **from the latter decades of the last century** that provides

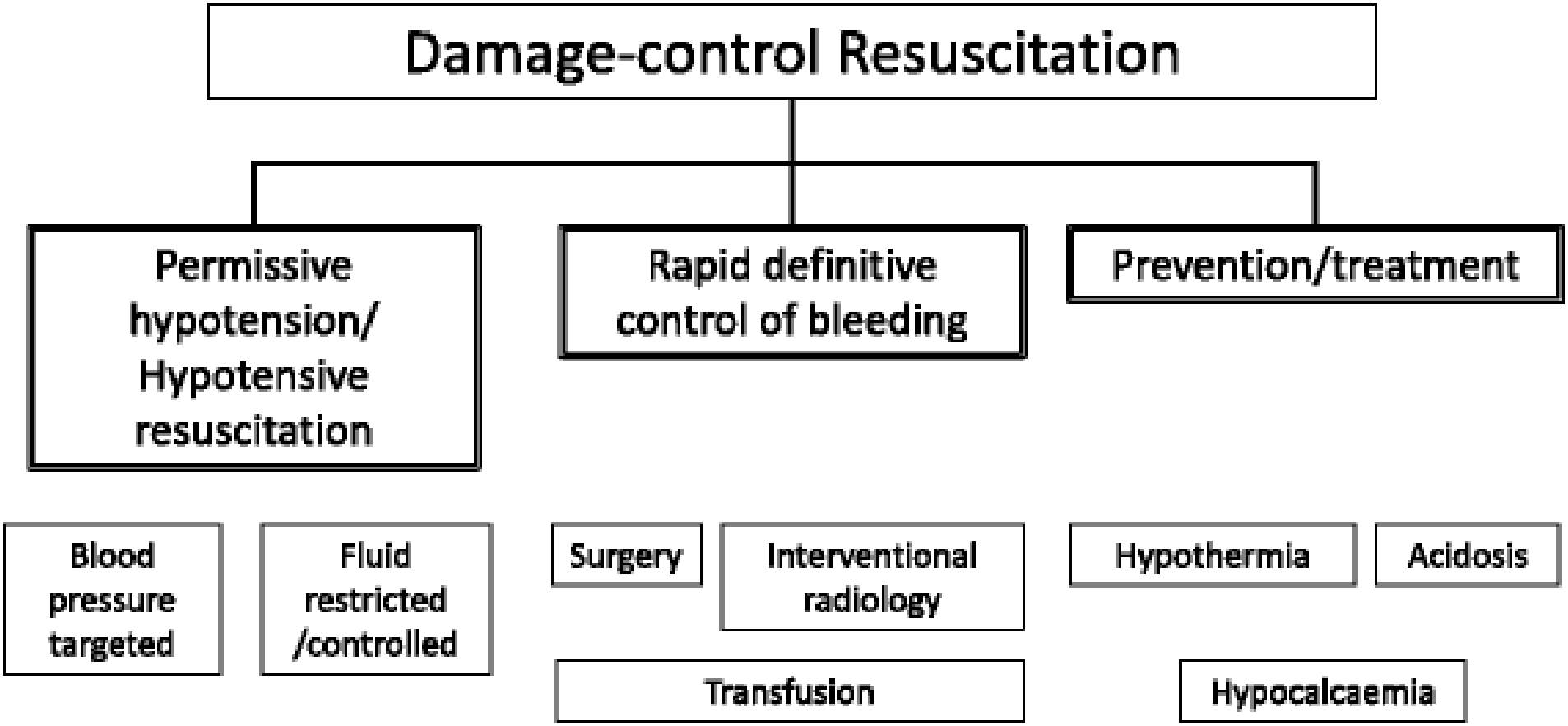
DC changed the age-old surgical dogma that all surgical procedures should be completed before leaving the operating room as it focused on limiting and/or treating deranged physiology before restoring normal anatomy.

Its innovation was greatly influenced by the **identification of coagulopathy as a principal cause of death in exsanguinating trauma patients** and the evolution of trauma resuscitation practices.

Its principles have now been used to reshape the practice of other civilian surgical subspecialties, military surgery, and trauma resuscitation itself

Roberts JD et all, History of the Innovation of Damage Control for Management of Trauma Patients: 1902–2016 ., Virginia Commonwealth University VCU Scholars Compass Surgery Publications Dept. of Surgery, 2017

DCR



Kudo D., Yoshida Y., Kushimoto S., Permissive hypotension/hypotensive resuscitation and restricted/controlled resuscitation in patients with severe trauma *Journal of Intensive Care,* 2017, 5:11

Massive bleeding

- 2nd most common cause of death in polytraumatic patients
- **the most comon cause of death in young people**
- **the most of death in war injuries**
- 60% mortality
- death occur fast (to 6 hours)

High morbility and mortality causes by „lethal trias“
HYPOTHERMIA, ACIDOSIS, COAGULOPTHY

In many cases the fatal outcome can be avoided

ACIDOSIS

- Hypovolemia
- Hypercarbia
- Medications
- Lactate
- Sedation/AMS
- Excess saline

BLEEDING !

COAGULOPATHY

- Dilutional
- DIC
- Medications
- Fibrinolysis
- Factor deficiency
- Acidosis
- Hypothermia

HYPOTHERMIA

- Environmental
- DM/thyroid
- Shock
- Cold fluids
- Burns
- TBI

RDCR principles: Blood Failure

P.Spinella: „Blood is an organ and can fail like any other organ“

- Term emphasizes the interaction between blood systems
  - Promote a balanced approach to resuscitation
- Balanced/simultaneous treatment
  - Shock, hemostatic and endothelial dysfunction
  - Prevents the exacerbation of another system

RDCR

Remote Damage Control Resuscitacion = pre-hospital /far forward / austere phase /application of DCR

The term RDCR was first published by Charhardt et all from US Army Institute of Surgical Research and since been promoted by the THOR Network

Gehardt RT, Strandenes G, Cap AP, Tentas FJ, Calssberg E, Mott J, et al., Remote damage control resuscitation and the Solstrand Conference: defining the need, the language, and a way forward, Transfusion, 2013: 53 (Suppl 1):9S-16S

Jenkins DH, et al.: THOR Position Paper on Remote Damage Control Resuscitation: Definitions, Current Practice and Knowledge Gaps, SHOCK, Vol.1, Supplement 3,, 2014.

= The Hemostasis and Oxygenation Research Network

From 2011, Bergen, Norway,
Annual RDCR symposium in June

RDCR

In military settings

= concept of active pre-hospital care for acute war-injuries with difficulty to control of bleeding, in combat situation, under fire and with a prolonged evacuation to ROLE with surgical care

RDCR is in priciples of TCCC

- Included hemostatic resuscitation

RDCR

Principles of RDCR are the same as DCR

Goals of RDCR are the same as DCR

Methods of RDCR are the same as DCR

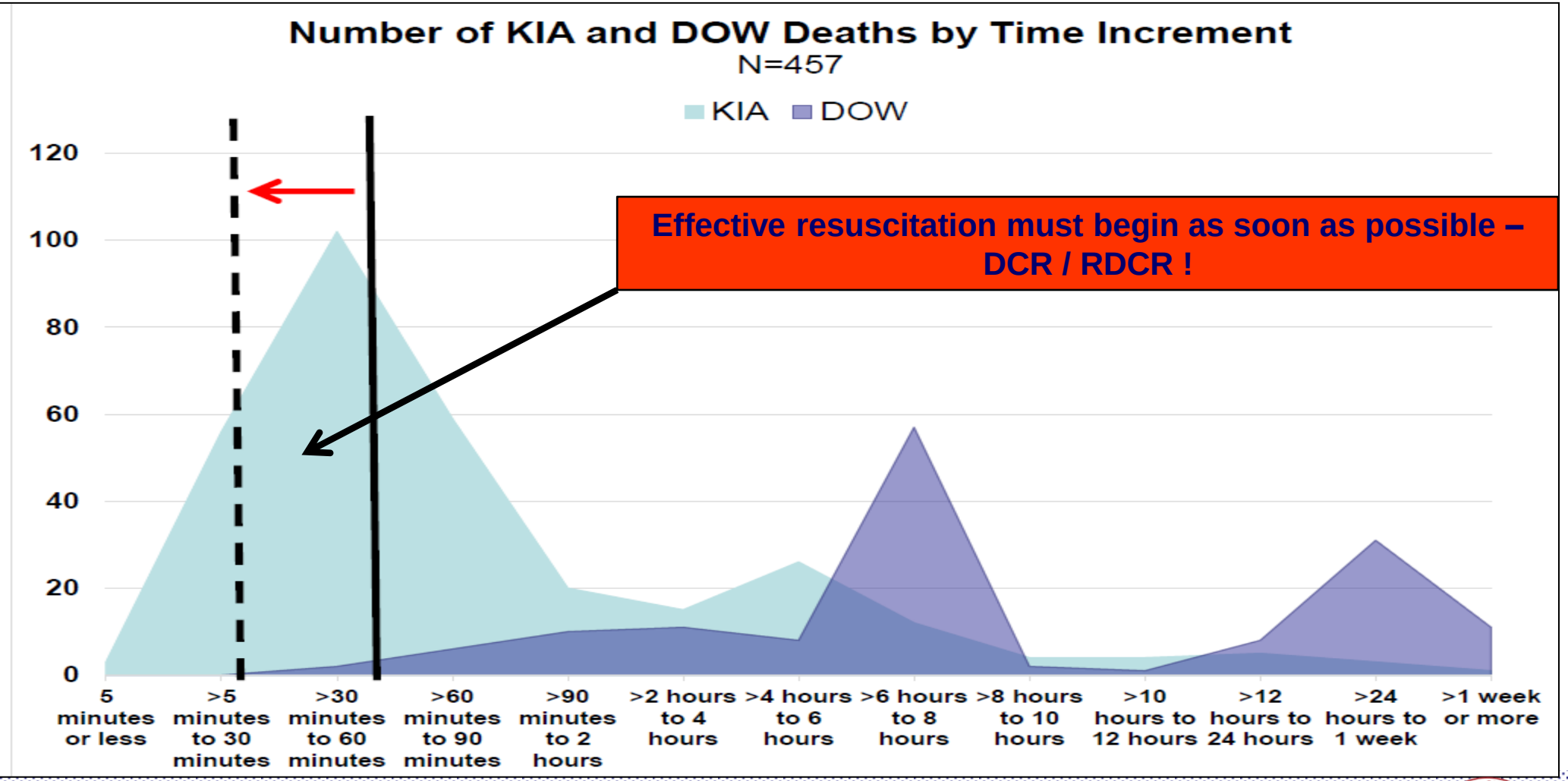
Differences:

- **Austeere environmet**
- **Technical, drugs and comfort limitation…**

Only early and aggressive treatment and application of hemostatic resuscitation principles may correct coagulopathy, control bleeding, has positive effect to survival and improve outcomes –

- „1st. golden hour rule“.

But: "golden hour" is not enough...



Shackelfor, et al, JTS, 2016

Blood far-forward !

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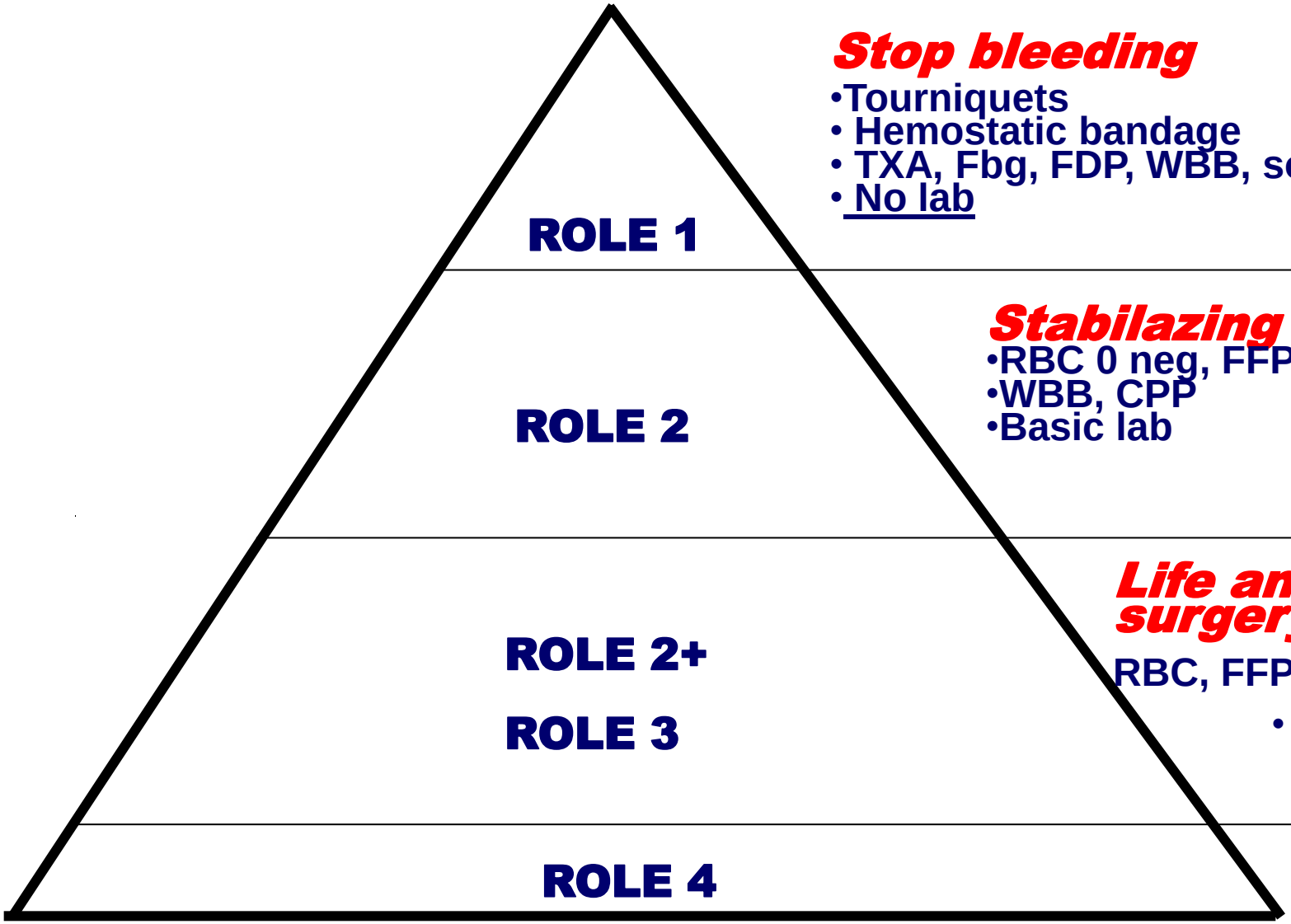


Stop bleeding

- Tourniquets
- Hemostatic bandage
- TXA, Fbg, FDP, WBB, solutions
- No lab

Stabilazing surgery

- RBC 0 neg, FFP AB, FDP
- WBB, CPP
- Basic lab

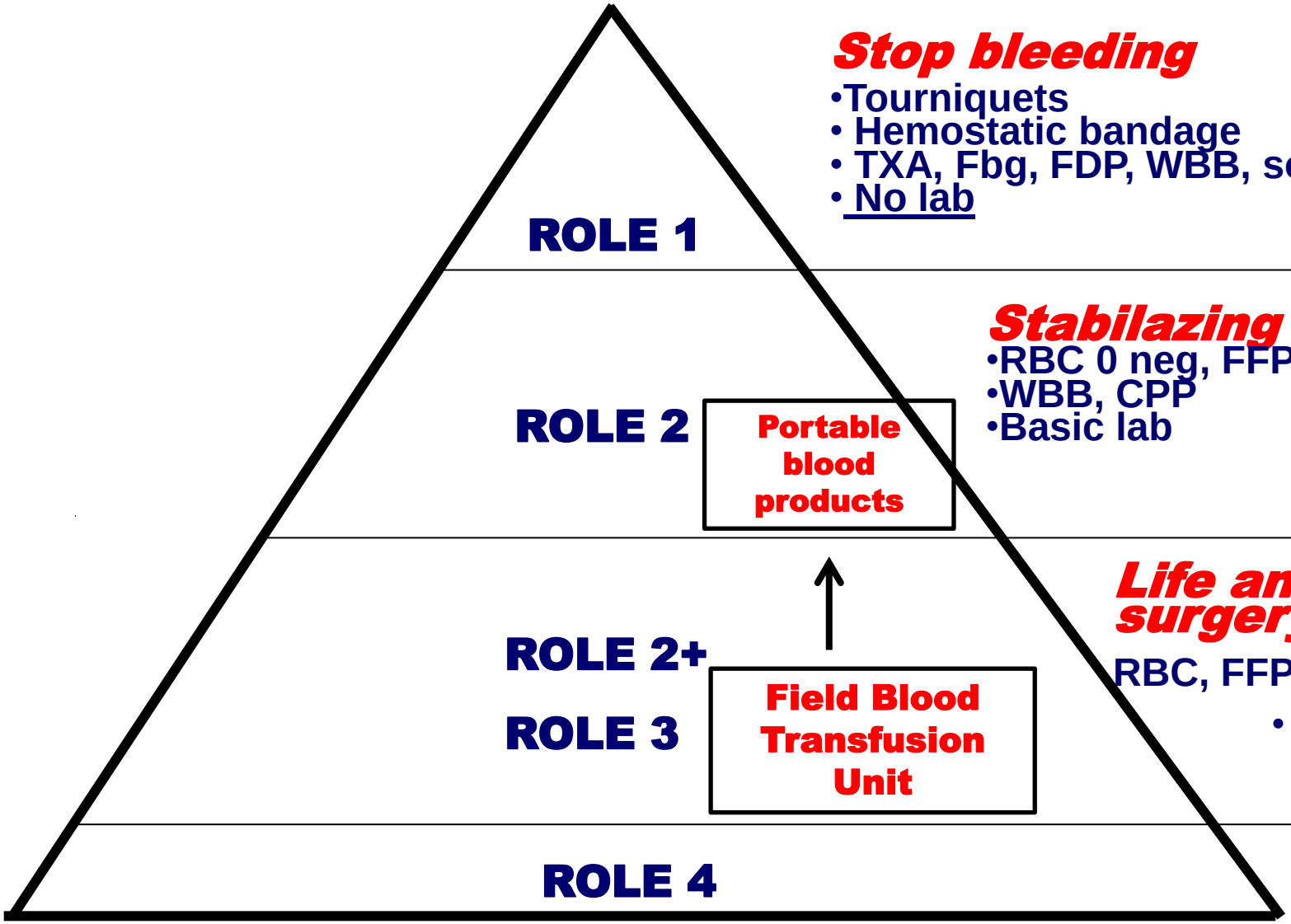
Life and limbs saving surgery, Intezive care

RBC, FFP, PLT-CPP

- blood bank, lab

Complex and spec. care

(territorial hospital)



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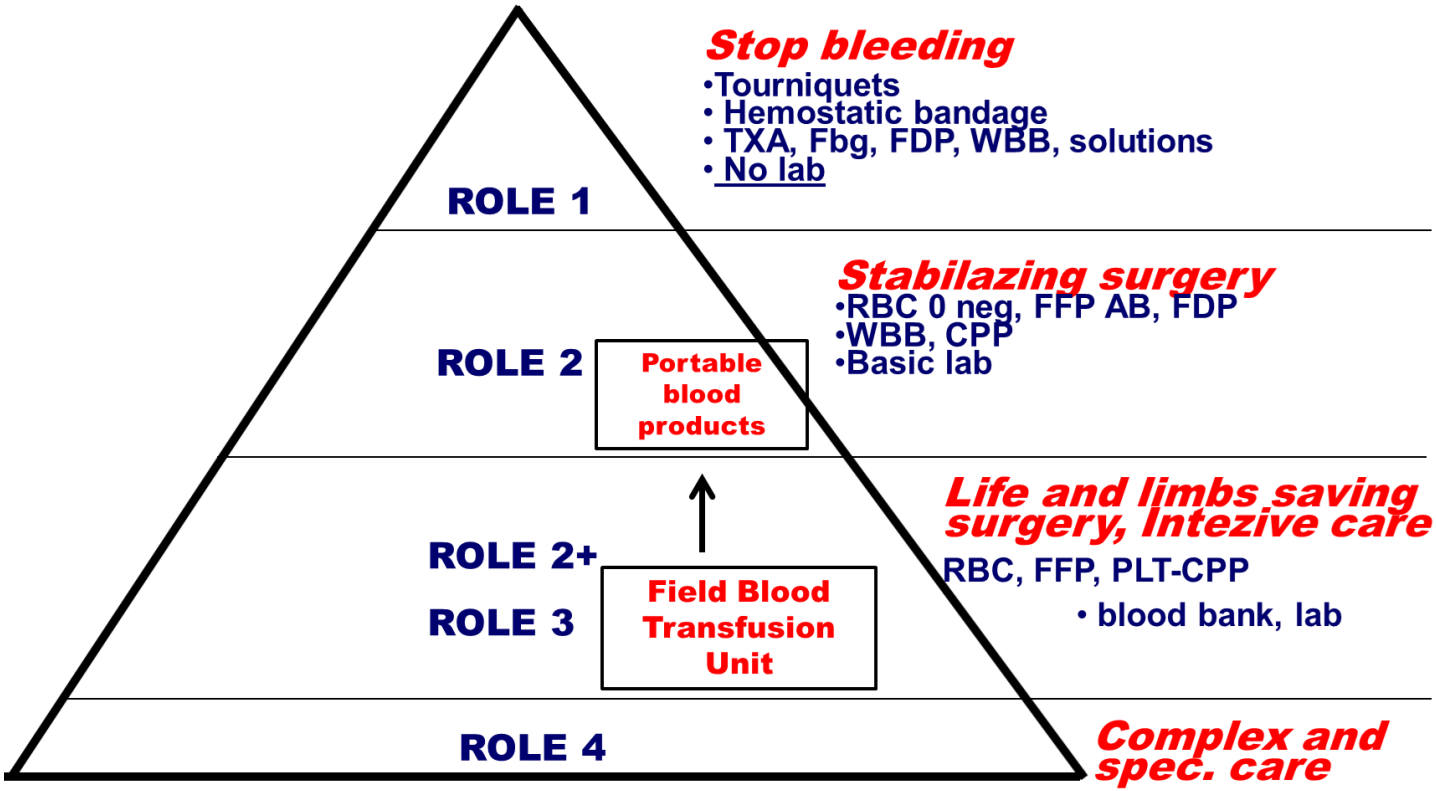
Stop bleeding
•Tourniquets
• Hemostatic bandage
• TXA, Fbg, FDP, WBB, solutions
• No lab
ROLE 1
Stabilazing surgery
•RBC 0 neg, FFP AB, FDP
•WBB, CPP
•Basic lab
ROLE 2
Portable blood products
Life and limbs saving surgery, Intezive care
RBC, FFP, PLT-CPP
• blood bank, lab
ROLE 2+
ROLE 3
Field Blood Transfusion Unit
ROLE 4
Complex and spec. care
(territorial hospital)

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

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SHOCK, Vol. 41, Supplement 1, pp. 3–12, 2014

Life Saving Intervention and Evacuation Location and Duration Definitions

A *lifesaving intervention* is defined as a medical procedure that if not performed conveys a high probability of increased morbidity or death. The terms *remote* and *forward* both are to be defined as the pre-hospital setting or phase of resuscitation. The terms *far-forward* and *austere* are defined as the environment where professional health care providers normally do not operate and basic equipment and capabilities necessary for resuscitation are often not available. Typically the austere environment poses challenges like limited access to power supply, sheltered treatment facilities, exposure to different light conditions, weather, altitude and ongoing threat from the enemy in military scenarios. To describe the duration of evacuation times, the term *delayed* evacuation will be defined as >60 minutes from wounding until reaching a medical treatment facility (MTF) that is capable of providing Damage Control Surgery (DCS) and DCR. The term *prolonged* evacuation will be defined as >6 hours from point of wounding until arrival at an MTF capable of providing DCS. These definitions apply equally to both civilian and military environments. While they could be considered somewhat arbitrary, they are commonly used definitions with evidence to support their use in literature. (31)

Hemostatic Adjuncts

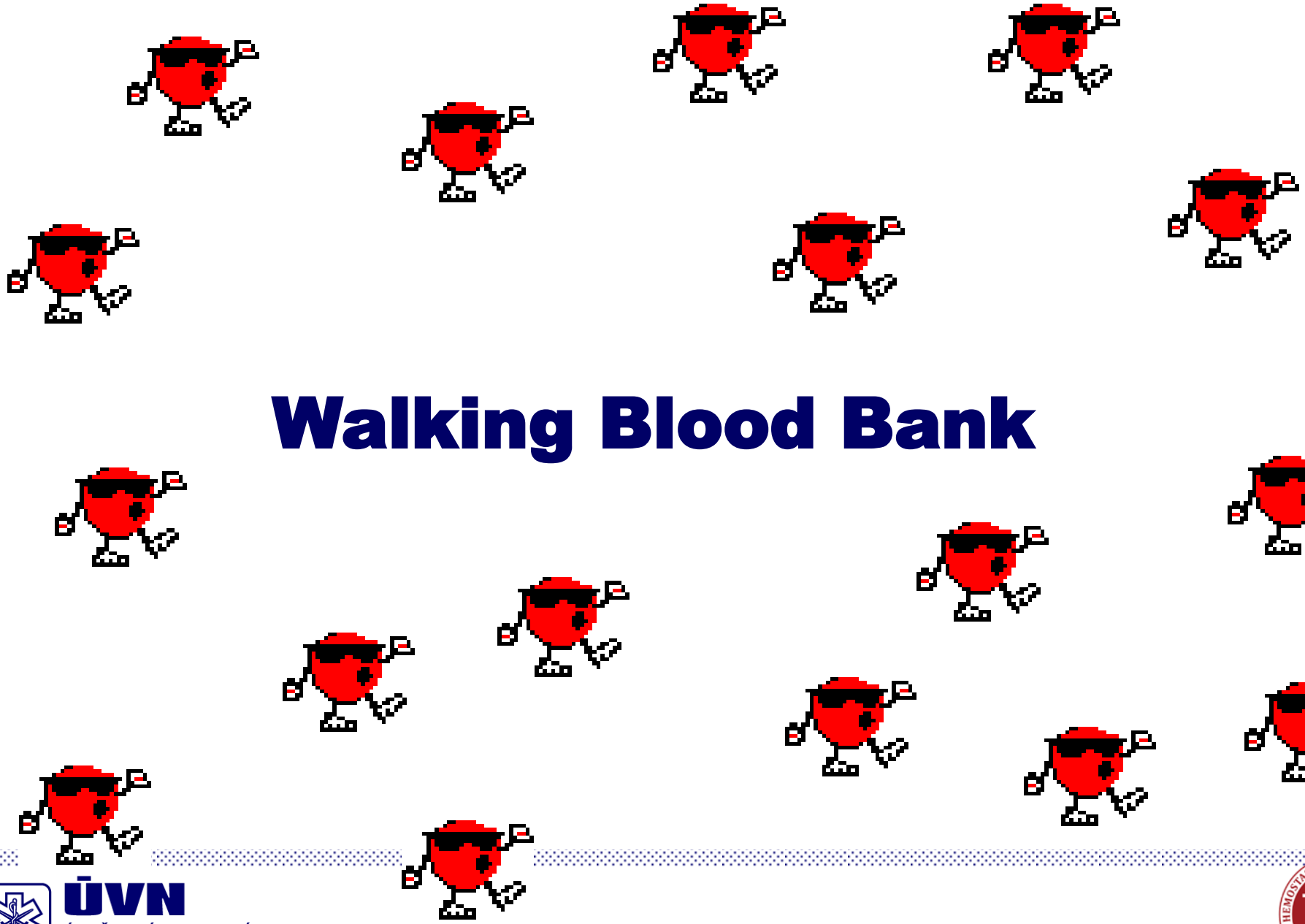
Hemostatic adjuncts are either mechanical or injectable. Both have advantages in different scenarios and can ideally be combined to best affect hemorrhage control.

Mechanical hemostatic adjuncts include; extremity tourniquets, junctional tourniquets, abdominal tourniquets and gauzes impregnated with pro-coagulants. More invasive types of mechanical devices to stop bleeding have recently gained increased interest. Resuscitative Endovascular Balloon Occlusion of the Aorta is an example of an emerging technique that might be considered for use in the prehospital environment.(32) *Injectable hemostatic adjuncts* include manufactured/derived hemostatic agents like plasma derivatives such as solvent detergent treated plasma or lyophilized plasma products, fibrinogen, prothrombin complex concentrates (PCC), Recombinant human Factor VIIa (rFVIIa), other factor concentrates, calcium, magnesium, and tranexamic acid (TXA).

Labile Blood Products and Biologics derived from Plasma

Several therapeutic products are derived from human blood, which in most countries, are divided into two *primary categories: 1) Labile blood products and; 2) biological medications* derived from plasma by fractionation and concentration techniques.

RCDR and Blood Far Forward - is not for military only !



Walking Blood Bank

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THOR
TRAUMA HEMOSTASIS & OXYGENATION RESEARCH

Attention, attention,

active walking blood bank !

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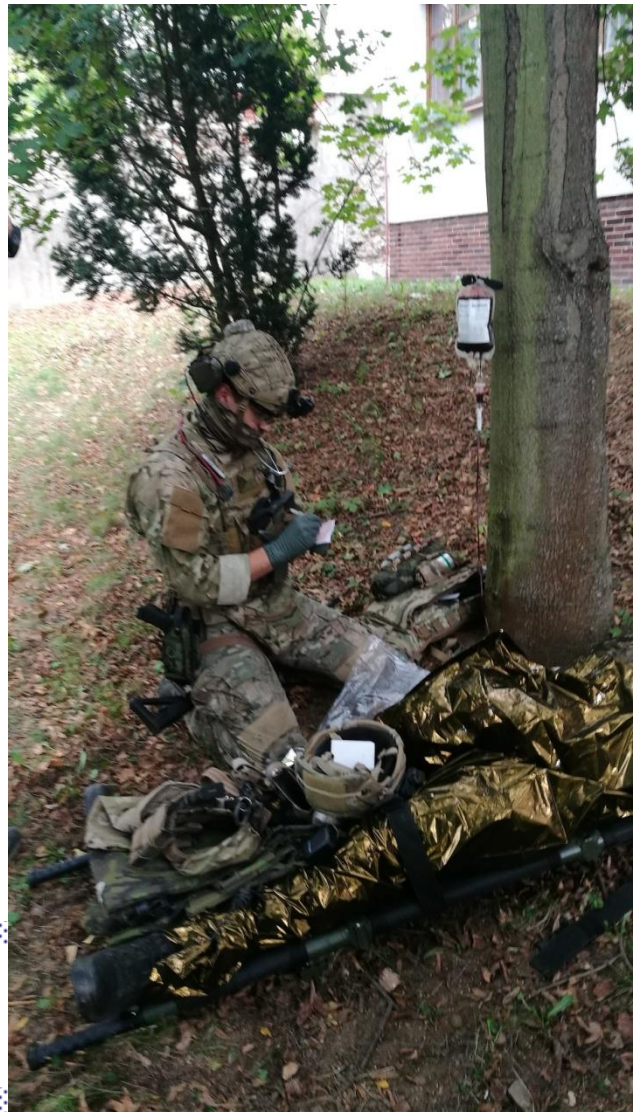

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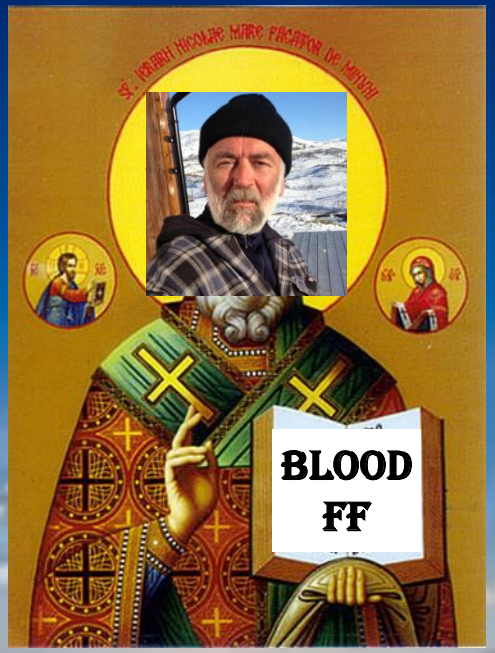
Walking Blood Bank -
is not for military only !

MEDECINS SANS FRONTIERES
LÉKAŘI BEZ HRANIC

Conclusion

RDCR is a modern concept of pre-hospital, life-saving care, for the wounded patients with massive bleeding

- for military in the field and in combat situations
- in defined settings of urgent prehospital care
- in remote areas
- during crisis situations



Welcome in Prague and thank you for attention !