



# WP-5: Use of Blood and Blood Products in Disasters

## 24-25.11.08, Israel



**Identifying the Needs of Medical First Responder in Disasters (NMFRDisaster)**  
**Theme 10 – Security; Call – FP7-SEC-2007-1**



# Workshop Agenda

## Day 1: 24th November 2008:

- Use of Whole blood and blood Component in Transfusion Therapy at the battle field and in field and conventional transfusion centers
- Alternatives/additions to conventional blood components therapy

## Day 2: 25th November 2008:

- Preparedness for Natural and Man-made disasters
- Rapid testing techniques
- Visit and tour of MDA blood services center



# Participants (1)

**Members of the consortium (in alphabetical order):**

**Ambulance Zorg, Nederland** : Dr. Charles Leikens, the Netherlands Military Blood Bank

**El-Quds University Palestinian Authority** :Mr. Sabri Safadi, El Quds

**Charles University, Czech Republic:**

**Lt. Col. Milos Bohonek**, MD, PhD, the Central Military Hospital, Prague,

**Dr. Martin Pisacka**, the Reference Laboratory for Immunohematology in Institute of Hematology and Blood Transfusion in Prague

**Fundacion Rioja Salud, Spain:** Dr. Roberto García de Villaescusa, MD, PhD

**MDA blood services, Israel:** Prof. Eilat Shinar, MD, director;

Dr. Vered Yahalom, MD, deputy director

**MDA project coordination:** Mr. Chaim Rafalowski; Mr. Assi Devilanski

**SAMUR Servicio de Asistencia Municipal de Urgencia y Rescate, Spain:**

Dr. I. Rodríguez Miguel MD; Ms. Paloma C. Rey Paterna

**Shield Group Inc. – Security and Counter Terrorism Management:**

Mr. Aaron Richman



## Participants (2)

Professionals from the participating members' countries and guests:

**Spanish Red Cross Transfusion Center, Madrid, Spain:**

**Dr. Emma Castro Izaguirre**

**Rambam Medical Center, Haifa, Israel: Dr. Eldad Dann,**

**Advisory Committee on Transfusion Medicine to the Israeli**

**Ministry of Health (chairperson):**

**Prof. Noga Manny**

**Sheba Medical Center, Israel:**

**Prof. Uri Matrinowitz**

**Assaf Harofeh hospital, Israel:**

**Dr. Neomi Rahimi-Levene**

**University of Alabama, Birmingham, USA:**

**Prof. Steven M. Becker**



# Participants (3)

- **Deputy to the Director general of the Israeli Ministry of Health**
  - **Dr. Boaz Lev**
- **Israeli Scientists form Biotechnology companies:**
  - **Dr. Amir Arav, Core Dynamics**
  - **Dr. Baruch Rivetz, Orgenics Ltd**
- **Other Israeli professionals, such as:**
  - **Representatives form the IDF (Medical Corps and Home Front Command)**
  - **Members of the Israeli Consulting committee for the Organization of Blood Services during Emergency situations**
  - **Senior staff of MDA blood services center**



# Use of Whole blood and blood Component in Transfusion Therapy at the battle field and in conventional transfusion centers

- ✓ Blood services worldwide must have a Plan of Action to meet surges in demand for blood components, needed by casualties of domestic disasters and acts of terrorism
- ✓ During disasters:
  - Higher requirement of blood may be expected
  - Disruption of normal collection, processing or distribution of blood components.
  - A massive influx of donors that may affect donations in subsequent months and diminish resources.
- ✓ A close coordination is needed with other blood centres, transfusion organizations, local and national health authorities, and rescue organizations

# Blood Crisis Policy in the Czech Republic



- In disaster it is estimated that 2% of the casualties will demand ~3000 units RBCs / day
- A system was created to guarantee unified organization, management and supply of blood and derivatives
- “Blood Crisis Centers” in 7 states (1 military and 6 civilian) which maintain minimal inventory
- “Central Informative and Logistic Centre”, Dep. of Hematology, Biochemistry and Blood Transfusion, The Central Military Hospital of Prague: Data collection and national inventory management
- A frozen inventory of 3000 RBCs units group 0.



**Přehled aktuálních strategických zásob krve v ČR k 05.09.2008**  
Přihlášený uživatel: upir Odlíšit: administrace

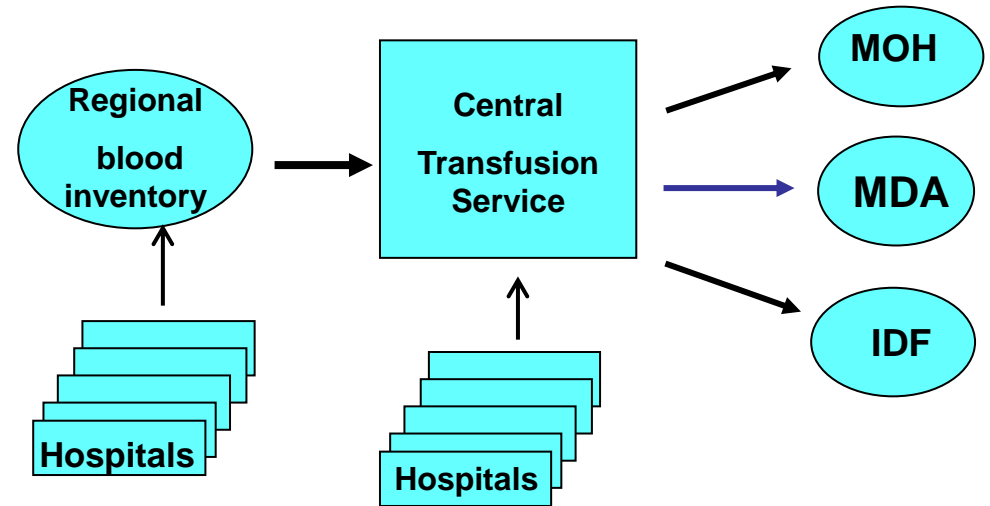
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<b>OHBKT UVN Praha</b>												
celkem po skupinách:	52	26	19	90	12	66	14	36	66	64	59	21
CELKEM po přípravcích:									210			
<b>FTO Praha 10 Kralovské Vinohrady</b>												
celkem po skupinách:	14	42	15	60	16	46	8	60	130	80	80	32
CELKEM po přípravcích:									322			
<b>FTO Plzeň</b>												
celkem po skupinách:	4	17	9	21	3	13	2	6	10	2	14	2
CELKEM po přípravcích:									28			
<b>FTO Hradec Králové</b>												
celkem po skupinách:	17	17	17	17	17	17	17	17	17	17	17	17
CELKEM po přípravcích:									68			
<b>FTO Brno</b>												
celkem po skupinách:	4	15	7	23	7	16	2	6	45	23	33	12
CELKEM po přípravcích:									113			
<b>FTO Olomouc</b>												
celkem po skupinách:	6	19	8	38	7	66	9	15	55	45	48	26
CELKEM po přípravcích:									174			
<b>Krevní centrum Ostrava</b>												
celkem po skupinách:	66	308	45	226	22	126	12	126	64	195	275	356
CELKEM po přípravcích:									890			
<b>Vše celkem po skupinách:</b>	163	444	120	475	84	350	64	266	387	426	526	466
<b>Vše CELKEM po přípravcích:</b>									1966			

Lt Col. Miloš Bohoněk, M.D, Ph.D

# Central Control of the Israeli National Blood Inventory

## ★ MDA Central blood services:

- Management of the national inventory
- Immediate notification from the scene
- Collection, component preparation, testing and distribution, nationwide



## ★ Hospital blood banks:

- Preparation of units for transfusion

## ★ Pre-hospital system:

- Use of “O” PC units only





# Organization of blood drives



## Planning collections:

- Determine the maximum capacity (personnel, collection material, time)
- Consider collecting only blood type O and Rh negative.
- Consider ABO/Rh typing for new donors.

## Crowd control:

- Long queues
- Trained personnel to organize queues; collect data and know when to say “no more donors are required”.
- Prepare additional sites

## Strategy with the Media:

- Coordinate with the authorities and coordinating body.
- Give a unified message.
- Nominate a spokesperson

Dra. Emma Castro Izaguirre

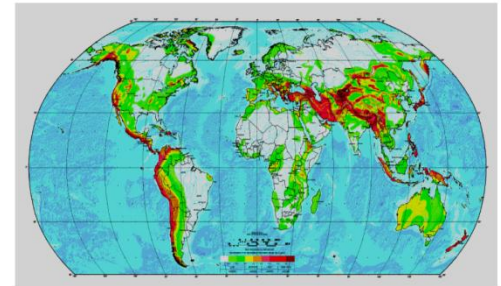


# Preparedness Plans for Disasters

- **Blood supply during Pandemia**  
Need to prepare for a low numbers of donors, limitation on public gathering and missing personnel
- **Blood supply during Earthquake**  
Need to coop with the above plus disruption of all activities due to massive damage to the infrastructure and chaos
- **Protection gears for the safe transfer of blood units and components**  
Need to identify the suitable material for transportation of blood units and components from blood drives and to the hospitals



GLOBAL SEISMIC HAZARD MAP



EARTHQUAKES: A WORLDWIDE PROBLEM



# Strategies to emergency planning



- Disaster Reduction & risk mitigation
- Organizing disaster response teams
- Assess vulnerability
- Identify areas in need of improvement
- Take preventive measures
- Exercising and drilling

- \* Respond according to response plans
- \* Check damage to facilities
- \* Assess the operational capacity

- Disaster-recovery
- Timely & cost-effective recovery

Yoshiaki Numata  
Japanese Red cross



## How much blood is needed in different disasters?

- ✓ Group O red blood cell concentrates should be dispatched immediately. Neither plasma nor platelets will normally be required - apart from exceptional circumstances
  - ✓ Overestimation of blood requirement by the Emergency Medicine experts during mass casualty episodes
  - ✓ **Spain:** 4.7 blood units and 2.3 components /casualty
  - ✓ **Israel:** 3 blood units and 3 components /casualty
- or
- 8 units / and 9.7 blood components severe & moderate
- ✓ **Turkey-1999; China-2008:**  
8.3 units / and 13.6 blood components severe & moderate



# Alternatives to Conventional Blood Components Therapy

## The Complex Mechanism and Treatment of Massive Bleeding in Trauma

Uri Martinowitz MD

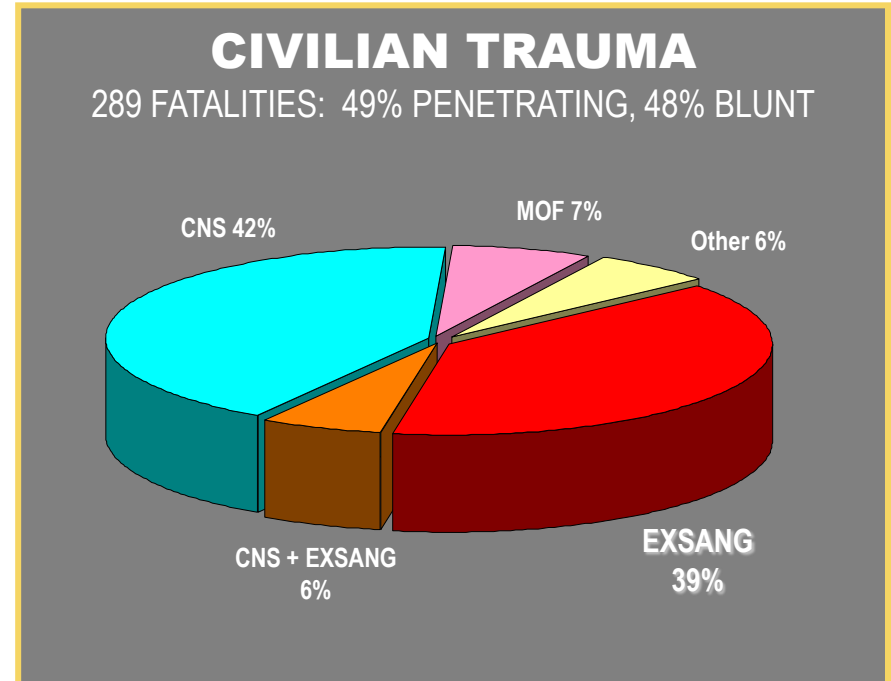
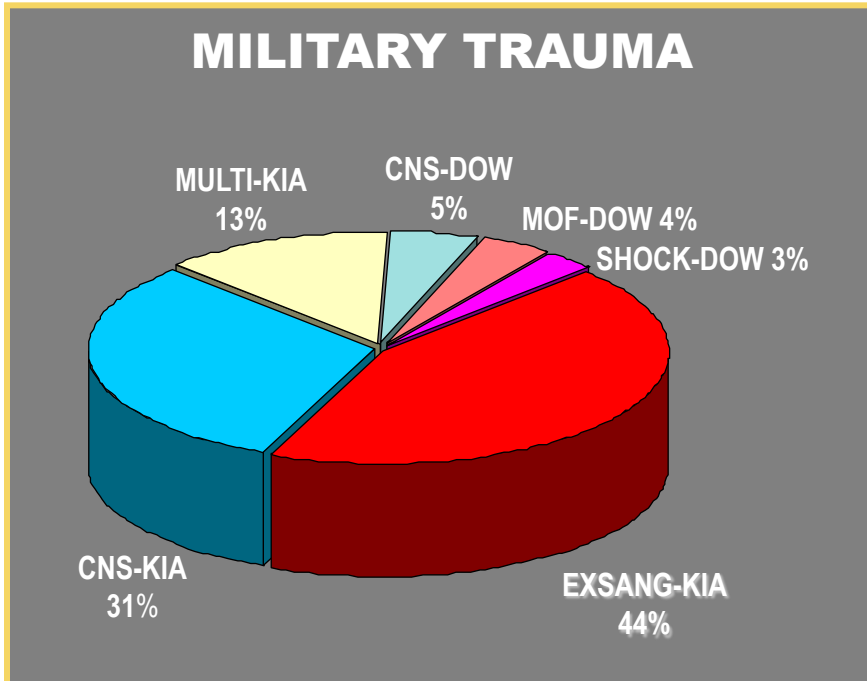
Institute of Thrombosis and Hemostasis

The National Hemophilia Center,

Sheba medical Center, Tel Hashomer, Israel



# Trauma Is the leading cause of death in the young Hemorrhage is a major cause of death in trauma



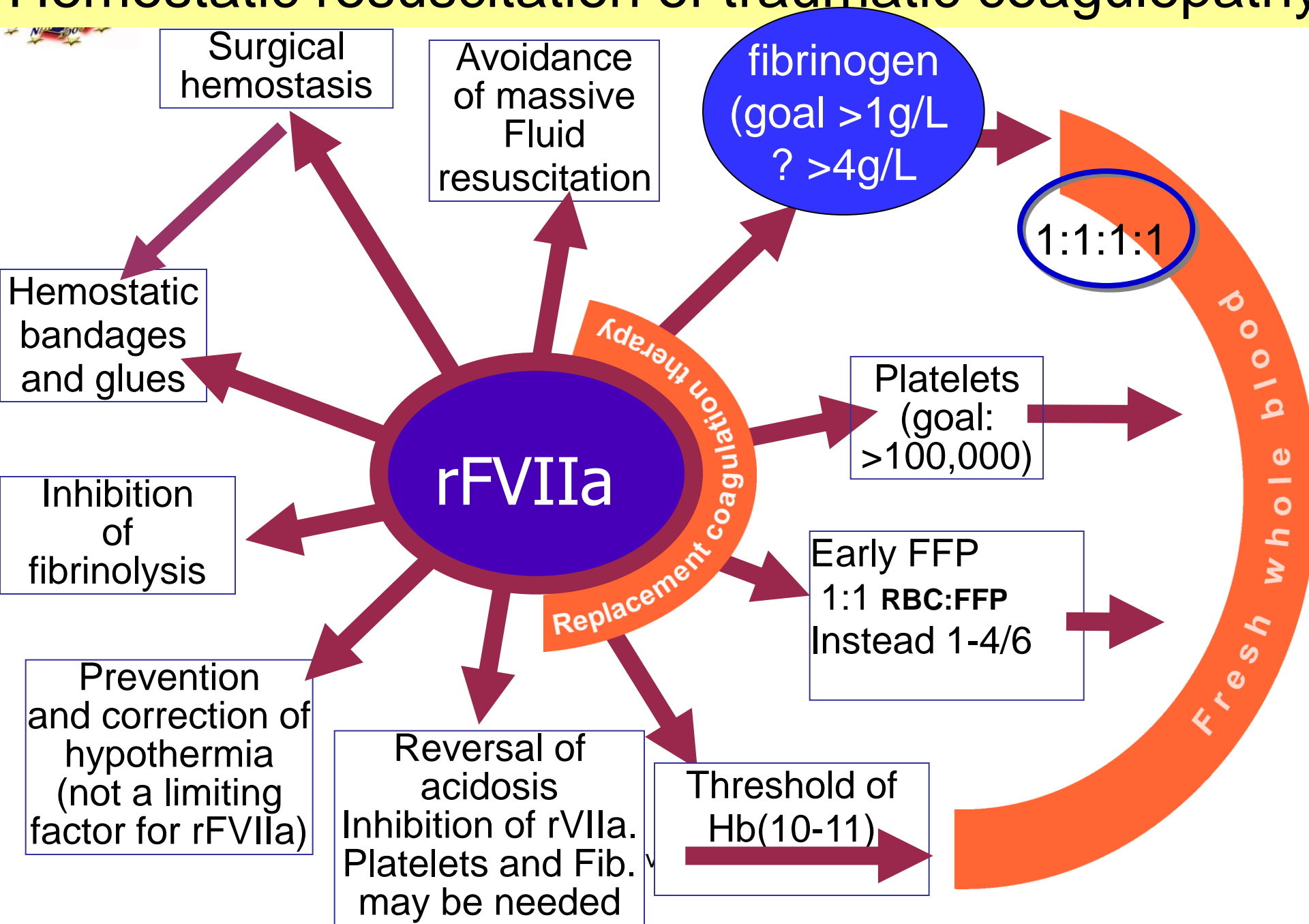
KIA – killed in action; DOW – died of wound;  
MOF – multiple organ failure.

Vietnam war 1967–1969; 8000 Casualties.

**140,000 deaths/year in the US**

Sauaia A et al. *J Trauma*. 1995;

# Hemostatic resuscitation of traumatic coagulopathy



# Coagulopathy is underestimated - we only see the tip of the iceberg

1. Lag time of 45-60 min. to results
2. Tests are performed at 37°C

Consumption

fibrinolysis

Hemodilution

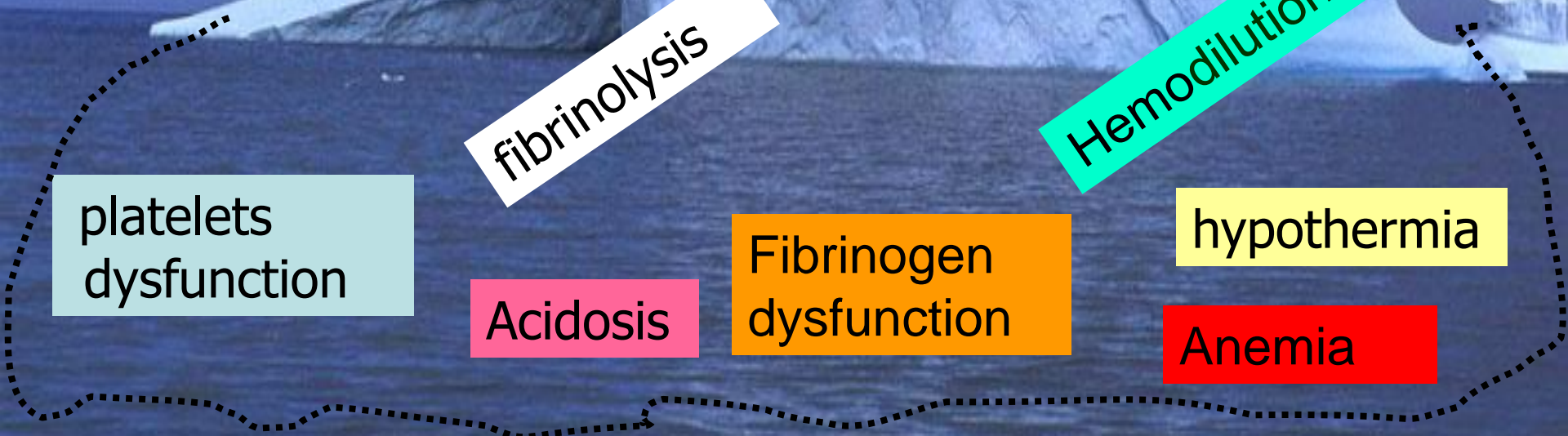
platelets  
dysfunction

Acidosis

Fibrinogen  
dysfunction

hypothermia

Anemia







# Alternatives to Conventional Blood Components Therapy

## TEG (Thrombo Elasto Graph)- Monitoring & Treating Bleeding Patients

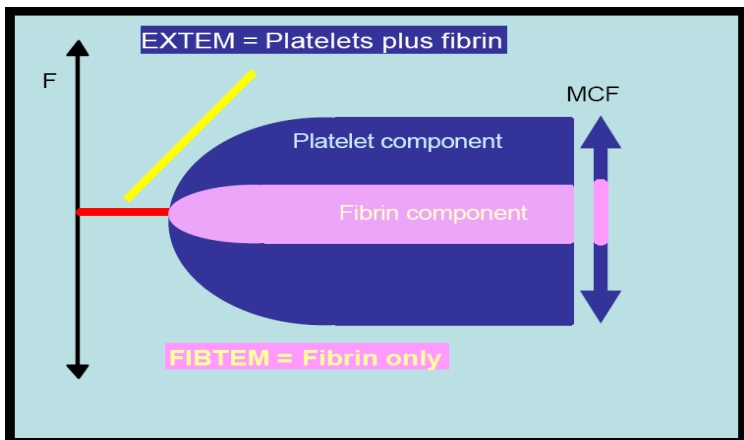
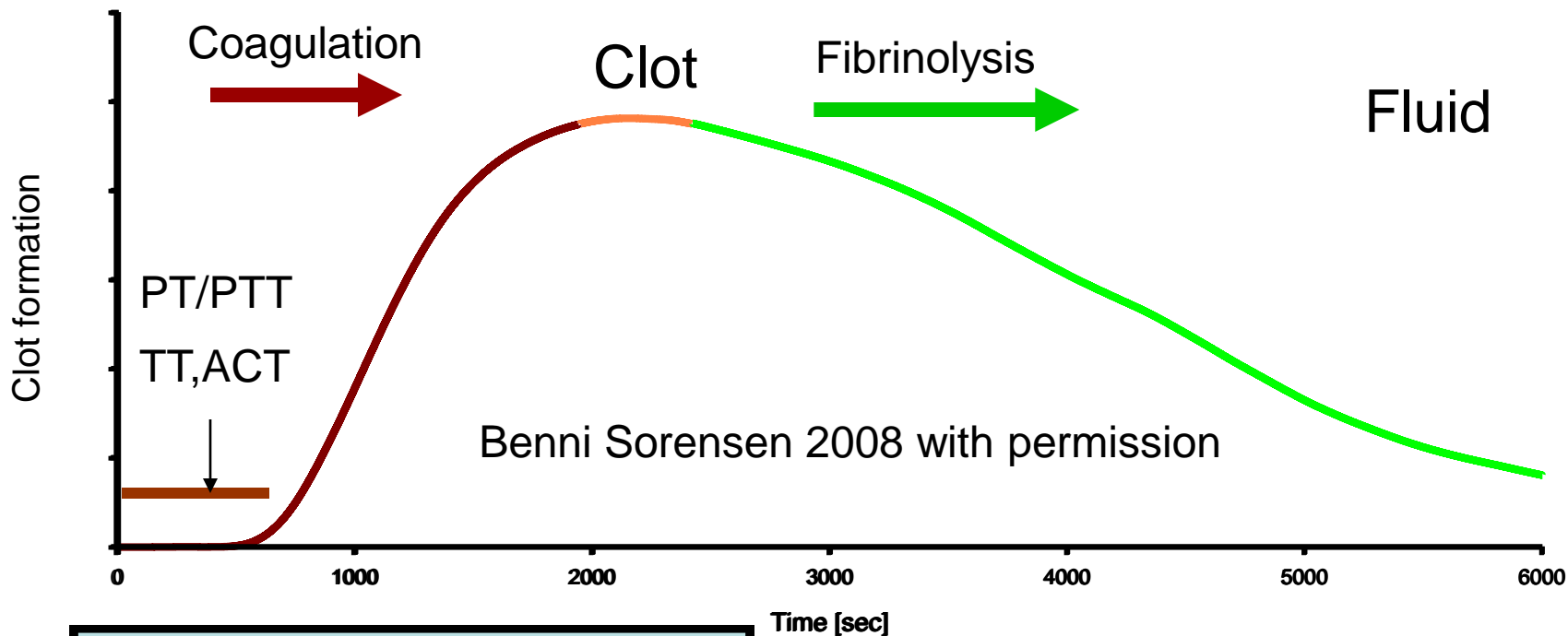
Naomi Rahimi-Levene MD, MHA  
Blood Bank Director  
Assaf Harofeh Medical Center  
Zerifin, Israel



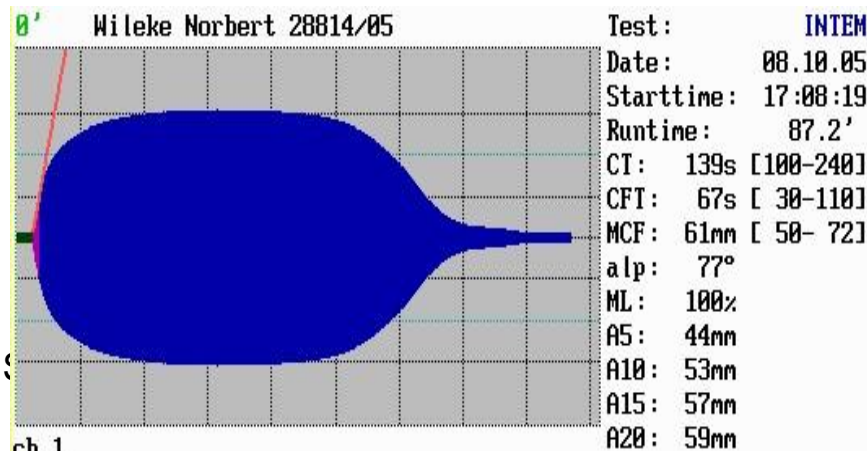


Standard coagulation tests are of limited value they only detect initiation of clot formation

Fluid

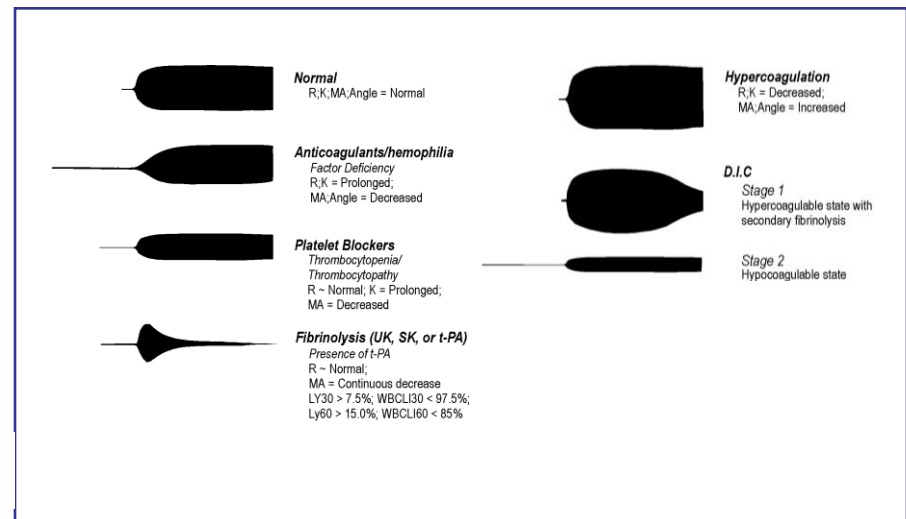
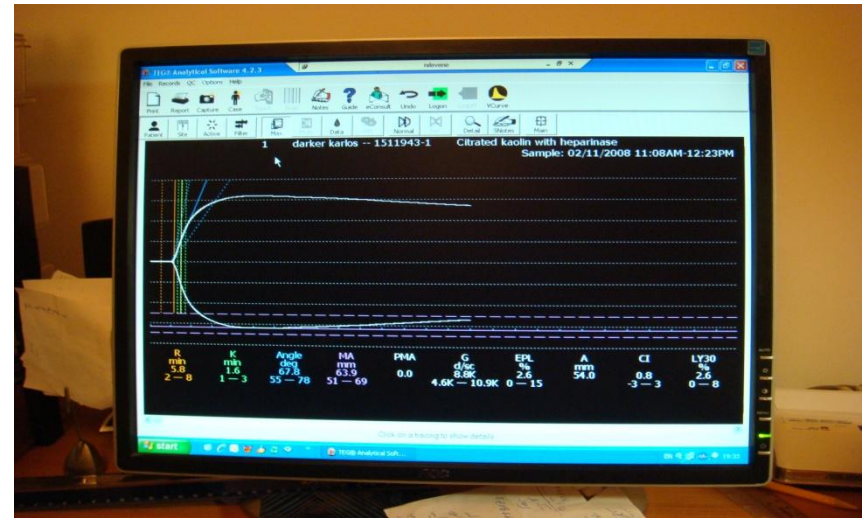
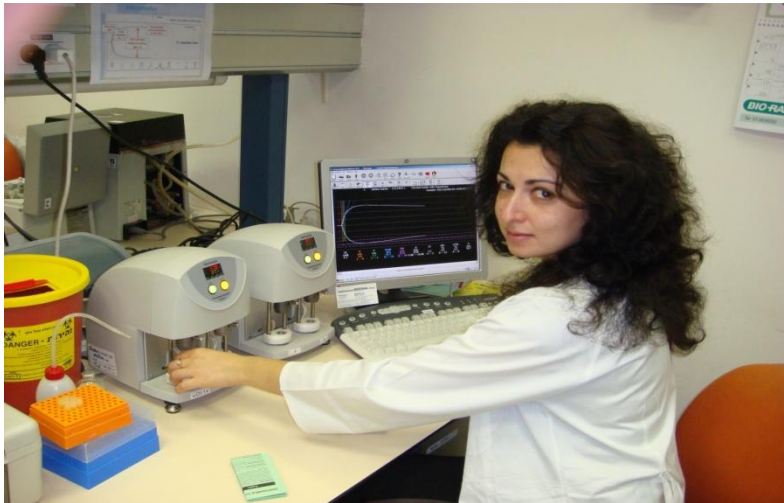


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# Using TEG in the Blood Bank





# Alternatives to Conventional Blood Components Therapy

## Experiences with frozen blood products in the Afghan theater (Aug 2006 – Aug 2008)

CCM Lelkens, SBB(ASCP)

Cdr (MC) (Royal Netherlands Navy)

CO NLD Military Blood Bank



# NLD Blood Products ISAF / OEF 2006 – 2008

## Liquid-frozen blood bank module

WORLD BRIEFING MAPS

### RC SOUTH

**(Three) Two NLD Liquid-Frozen Blood Banks**  
**OEF / ISAF 2006 - 2008**



### MILITARY BLOOD COMPONENTS

(Role 2 and 3 MTF's)

- O Platelets (25-50 U) 2 y -80° C \*
- AB Plasma (50-75 U) 7 y -80° C \*
- O Red Cells (50-100 U) 10 y -80° C \*\*

\* + 6 hrs at 22 C after thawing / mixing

\*\* + 14 days at 4 C after sterile thawing and washing

pts. were Tx. With 2500 frozen blood components

Produced by DGI, Ministry of Defence, United Kingdom 2006  
NOT TO BE USED FOR ACCURATE POSITIONING OR DISTANCE MEASUREMENT  
LIMITED DISTRIBUTION  
UK Official: not to be re-used or re-issued - document out of date  
UK Government Service without prior permission from CIG (UK)



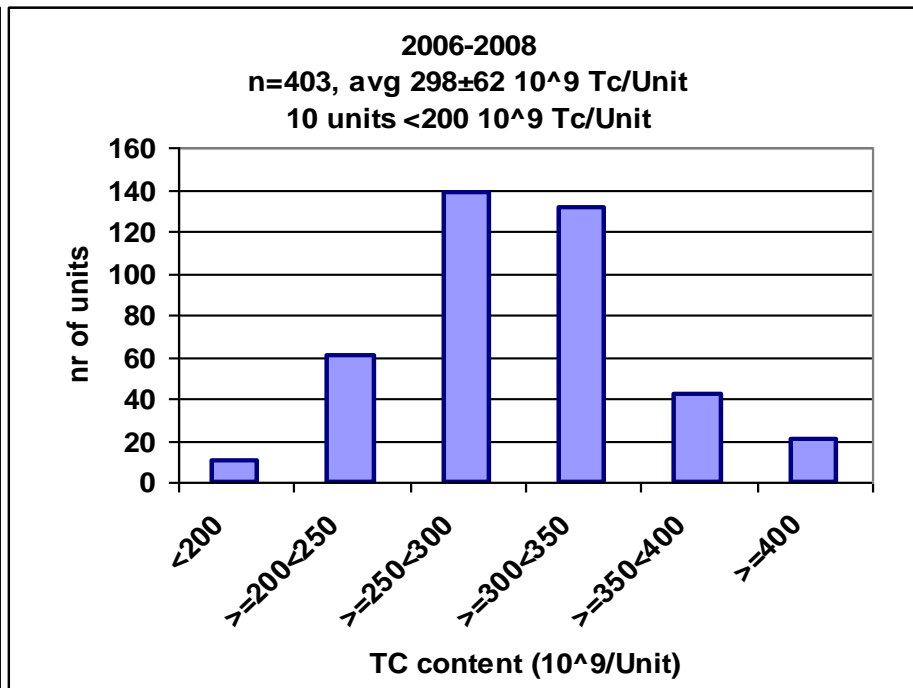
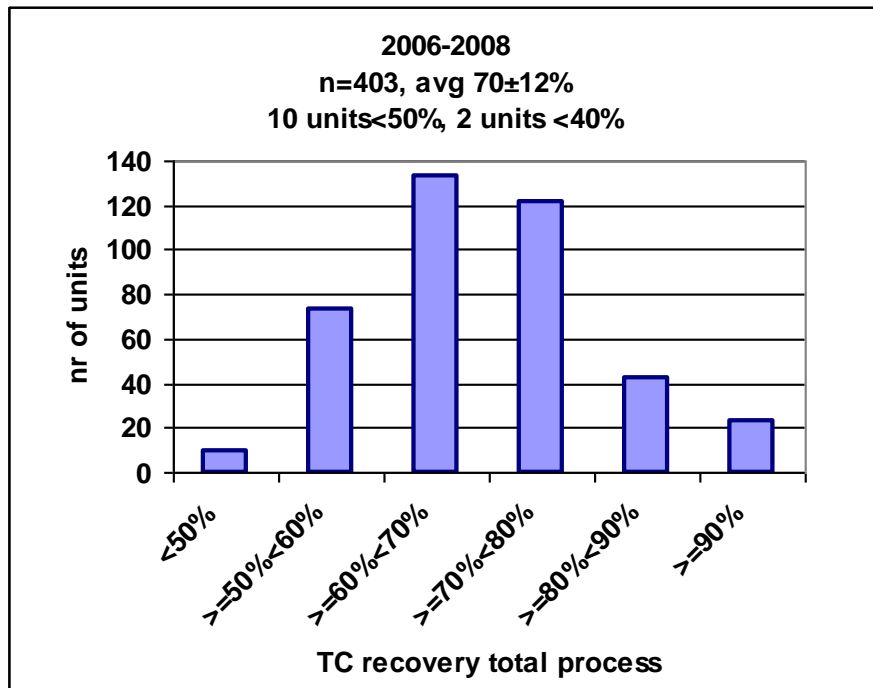
## Patients transfused with NLD products (2006-2008)

Nr of Patients		Percentage	F-RBC	FFP	F-Pit's	L-RBC
AFG	334	84.13	778	710	286	377
UK	22	5.54	3	88	3	13
CAN	14	3.53	43	32	16	10
US	12	3.02	18	74	41	0
NLD	8	2.02	86	113	33	67
AUS	2	0.50	7	3	1	0
Unk	5	1.26	6	3	1	2

**Total: 397 100 941 1023 381 469**



# Frozen Platelets: Recovery and Plt Count



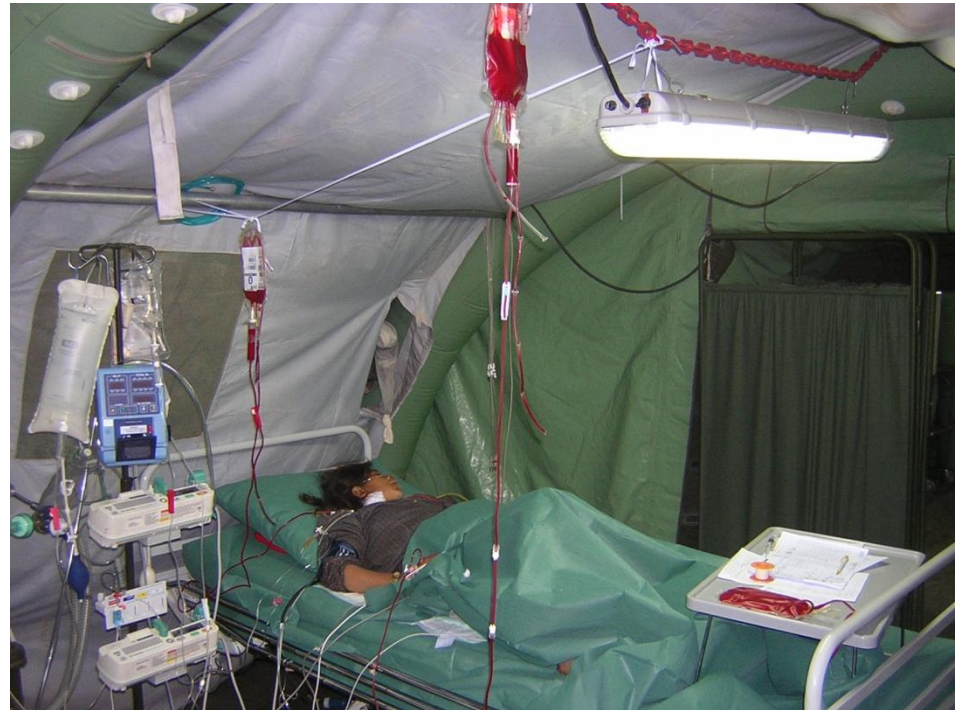
Plt Units Transfused: 403

Recovery: 70 ± 12%

Plt Count: 298 ± 62 x 10<sup>9</sup>/U



# NLD Blood Products ISAF / OEF 2006 - 2008







# Alternatives to Conventional Blood Components Therapy

## Frozen and freeze dried blood in disasters Dr. Amir Arav, Core Dynamics, Israel

### The process

- To develop a frozen and a freeze dried RBC unit which is safe, easily transportable, and ready for use upon rehydration
- Developed a novel freezing device which is based on directional freezing, allowing control over ice crystals morphology during the freezing process
- Developed a specific equipment for thawing of RBC within 2 minutes
- In the process of development of lyophilization of RBC and their rehydration with NaCl



# Alternatives to Conventional Blood Components Therapy

**Frozen and freeze dried blood in disasters**

**Dr. Amir Arav, Core Dynamics, Israel**

## Experimental Data

- **100% recovery of the cells with less than 3% hemolysis after freeze thawing**
- **Autologous transfusions of fluorescent labeled 0.5L thawed RBCs to donkeys showed in vivo recovery of 80% 24 hours post transfusion and 3 months survival in the circulation**
- **Initial experiments on freeze dried RBCs showed ATP and 2,3 DPG values similar to fresh samples**
- **Frozen and freeze dried RBCs maintained their blood types upon thawing or rehydration.**

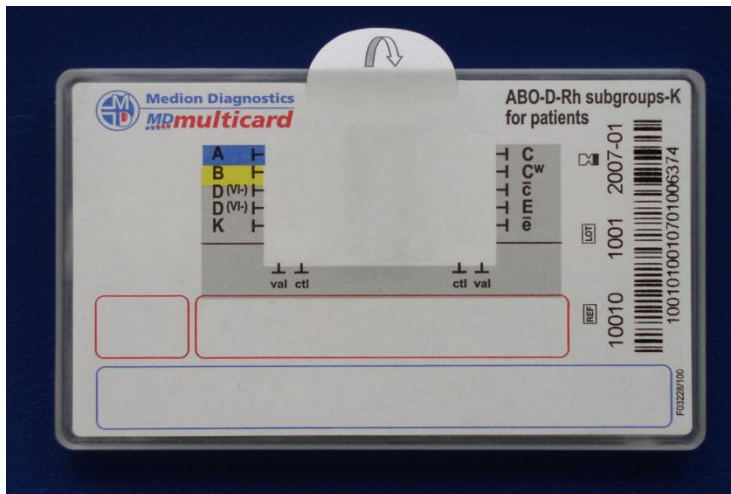
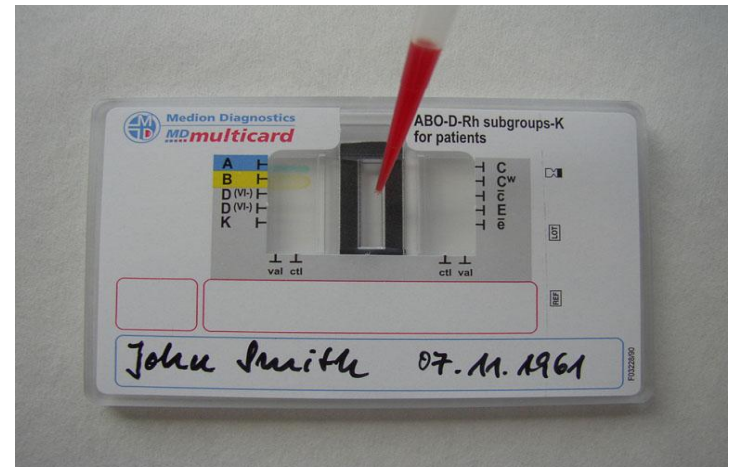




# Rapid testing techniques (1)

## Blood type determination:

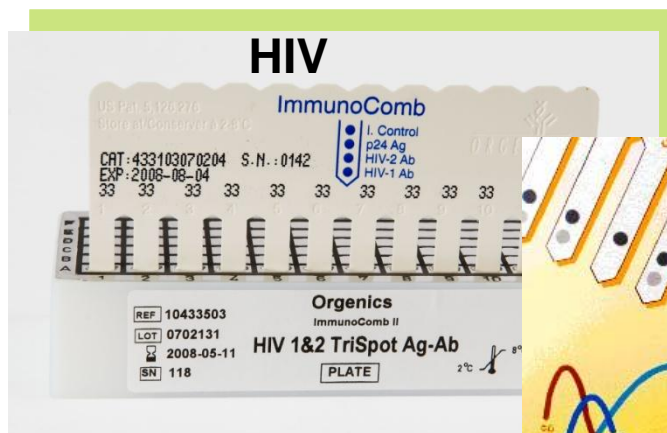
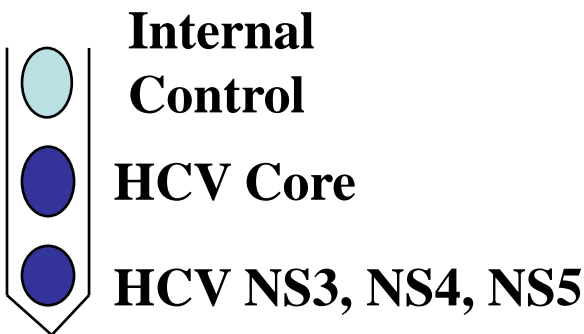
Dr. M. Písačka, from the Reference Laboratory for Immunohematology Institute of Hematology and Blood Transfusion Prague, Czech Republic: Lateral Flow Device with Stable End-Point without Centrifugation, For ABO and RhD determination.





# Detection of Transfusion-Transmitted Infectious Agents

- Full panel for **HIV** detection
- A third-generation test for qualitative detection of **anti HCV IgG antibodies** in human serum or plasma.
- Simultaneous and differential detection of antibodies to Core and non-structural Antigens (NS3, NS4, NS5)
- Test duration – 36 minutes at room temperature
- **Hepatitis B virus surface antigen (HBsAg)** in human serum or plasma
- Test duration- 90 minutes at 37C





# Future projects for submission

- Building training programs for medical first responders in central blood services and hospital blood banks, during various man-made and natural disasters (drills and training exercises)
- Monitoring "on-line" coagulopathy patterns and treatment modalities : a multi-center study
- Adequate usage of blood units and components in Trauma patients with severe coagulopathy and bleeding
- Quality and characteristics of frozen and freeze dried RBC units
- Characterization of protected “gear” for blood units and components against chemical/biological hazards



# 1. Building training programs for medical first responders in central blood services and hospital blood banks, during various man-made and natural disasters

- Build appropriate response plans of action
- Organizing disaster response teams
- Take preventive measures
- Exercise and perform adequate drills



## 2. Monitoring "on-line" coagulopathy patterns and treatment modalities : a multi-center study

### Study Proposal

- Trauma patients – massively bleeding
- TEG on pre-hospital care and on entry to OR
- After receiving replacement therapy - TEG
- If bleeding continues re-evaluate TEG
- TEG when patient stabilizes
- In parallel – conventional tests: CBC, PT, APTT, fibrinogen



### 3. Adequate usage of blood units and components in Trauma patients with severe coagulopathy and bleeding

Although, currently it seems that the majority of situations do not require extensive use of platelets or plasma, which seem in severe trauma cases be only necessary in special circumstances, the workshop participants thought it could be interesting and useful to conduct a multi-center study, looking at the usage of blood components in severe trauma cases, especially in view of the new treatment regimen of component therapy (1:1:1) recommended lately in the literature





## 4. Quality and characteristics of frozen and freeze dried RBC units

- Currently, RBC units are mostly preserved in a liquid state up to a maximal duration of 42 days, depending on the preservative solution used.
- Less than 1% of the collected blood is being frozen
- Using Core Dynamics directional freezing process RBC's can be frozen, lyophilized and thawed within 2 minutes
- Further safety and in-vitro studies are required in order to finalize the frozen thawed RBC procedure and to be able to start and use it as a fully developed product
- Further research is needed for other blood components



## 5. Identification of proper protective “gears” for transportation of blood units and components under HAZMAT threat

- Ensure non-penetration of chemical/biological materials to the bags
- Ensure proper penetration of oxygen to blood and platelets bags
- Decontamination methods
- And more.....



# Thank you!

