AMIT TUDNI AKARSZ A VÉRZÉSRŐL ‚DE SOSEM MERTED MEGKÉRDEZNI

„DAMAGE CONTROL”

Varga Csaba

SM Kaposi Mór Oktató Kórház

Sürgősségi Betegellátó Centrum

MI IS AZ A DAMAGE CONTROL?

damage control (*countable* and *uncountable*, *plural* damage controls)
A department or group, as aboard a naval vessel, responsible for taking action to control damage caused by fire, collision, etc.

Any efforts, as by a company or organisation, to curtail losses, counteract unfavorable publicity, etc

Kármentés, kárelhárítás

FOGALOM

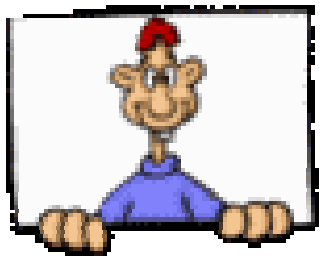
„The concept of damage control (DC) is based on a sequential therapeutic strategy that favors physiological restoration over anatomical repair in patients presenting acutely with hemorrhagic trauma …”

Damage control: Concept and implementation
Malgras et al

Journal de Chirurgie Viscérale, Available online 29 September 2017,

A ”kármentés”(DC) fogalma olyan szekvenciális terápiás stratégián alapul, amely az élettani állapot rendezésével kedvezően befolyásolja az anatómiai helyreállítást a vérzéses traumát szenvedett betegekben

TÖRTÉNETI KITEKINTÉS



A „DAMAGE CONTROL” HISTÓRA

1910-es évek

1940-es évek

1918 W. Cannon
permissiv hypotenzio elve

1908 J Hogarth Pringle,Ann Surg.
V. Notes on the Arrest of Hepatic Hemorrhage Due to Trauma

US NEVADA 1941 december 7

1990-es évek

Burch at al ,1992
halálos triász

1993

ROTONDO at al.**"'Damage Control'".** *The Journal of Trauma: Injury, Infection, and Critical Care*. **35** (3): 375-383.

2000-es évek

Damage control Surgery
2001 B.A Hoey
2004 Schneider at al
2009 S.S Januoo

Damage control resustitation
Hollcomb 2007
HoDgetts 2007
Pohlman 2015

2010

RDCR
Remote DCR

RAUMA HEMOSTASIS &OXYGENTION RESEARCH

Dr. Geir Strandenes
medical director
Norwegian Navy

Prof.Philip C Spnella
Washington University
Critical Care &Pediatric Division

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.

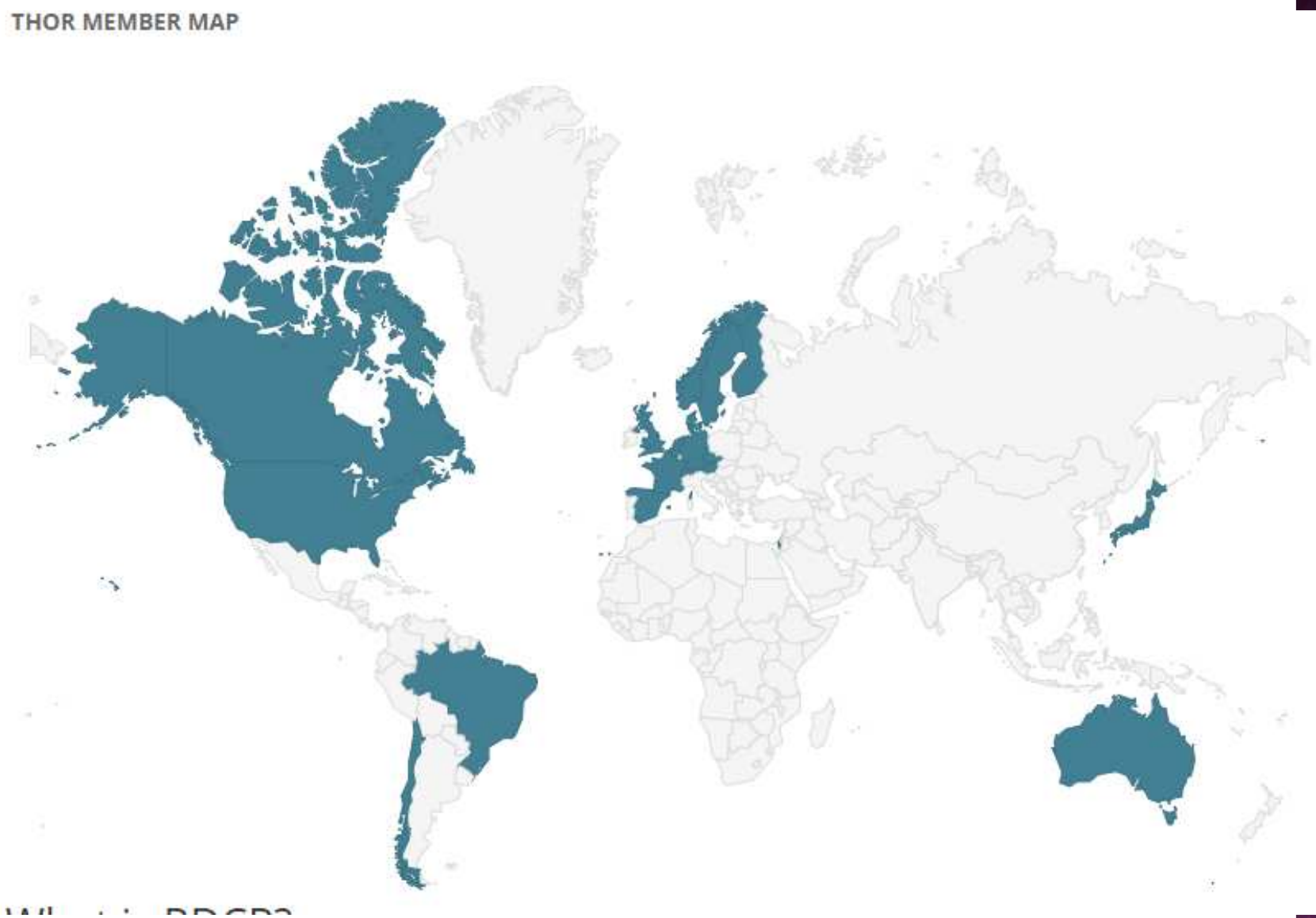
VISION: To improve outcomes from traumatic hemorrhagic shock by optimizing the acute phase of resuscitation.

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

http://rdcr.org/

A RÉSZTVEVŐ ORSZÁGOK



REMOTE DAMAGE CONTROL RESUSCITATION

Gerhardt RT, Berry JA, Blackbourne LH. **Analysis of life-saving interventions performed by out-of-hospital combat medical personnel.** J Trauma. **2011**;71(1 Suppl):S109–S113.

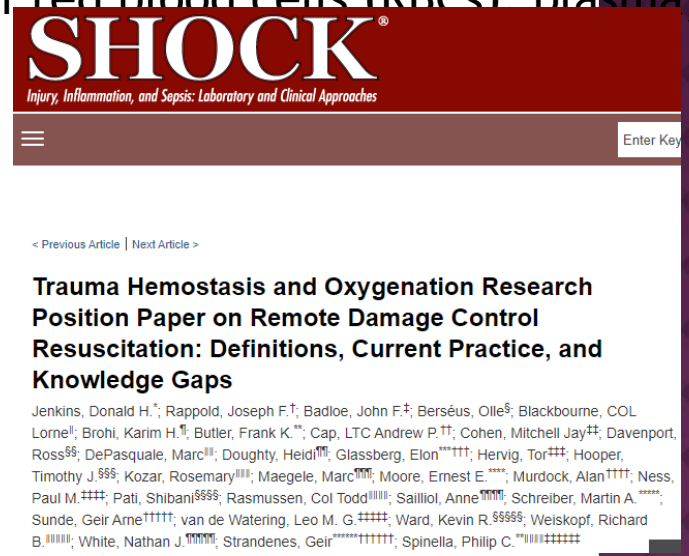
Strandenes G, Spinella PC. **The Solstrand remote damage control resuscitation symposium.** Transfusion. **2013**;53(Suppl 1):6S–8S.

Gerhardt RT, Strandenes G, Cap AP, Rentas FJ, Glassberg 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.

REMOTE DAMAGE CONTROL RESUSCITATION

RDCR has been defined as the pre-hospital application of Damage Control Resuscitation (DCR) concepts (1, 2). DCR principles include: compressible hemorrhage control; hypotensive resuscitation; rapid surgical control of bleeding; avoidance of the overuse of crystalloids and colloids, prevention or correction of acidosis, hypothermia, and hypocalcemia; and hemostatic resuscitation (early use of a balanced amount of red blood cells (RBCs), plasma, and platelets).(3)

Jenkins at al. 2014
THOR Position Paper on Remote Damage Control Resuscitation: Definitions, Current Practice and Knowledge Gaps


SHOCK®
Injury, Inflammation, and Sepsis: Laboratory and Clinical Approaches

Enter Key

< Previous Article | Next Article >

Trauma Hemostasis and Oxygenation Research Position Paper on Remote Damage Control Resuscitation: Definitions, Current Practice, and Knowledge Gaps

Jenkins, Donald H.*; Rappold, Joseph F.†; Badloe, John F.‡; Berséus, Olle§; Blackbourne, COL Lorne‖; Brohi, Karim H.¶; Butler, Frank K.**; Cap, LTC Andrew P.††; Cohen, Mitchell Jay‡‡; Davenport, Ross§§; DePasquale, Marc‖‖; Doughty, Heidi¶¶; Glassberg, Elon***†††; Hervig, Tor‡‡‡; Hooper, Timothy J.§§§; Kozar, Rosemary‖‖‖; Maegele, Marc¶¶¶; Moore, Ernest E.****; Murdock, Alan††††; Ness, Paul M.‡‡‡‡; Pati, Shibani§§§§; Rasmussen, Col Todd‖‖‖‖; Sailliol, Anne¶¶¶¶; Schreiber, Martin A.*****; Sunde, Geir Arne†††††; van de Watering, Leo M. G.‡‡‡‡‡; Ward, Kevin R.§§§§§; Weiskopf, Richard B.‖‖‖‖‖; White, Nathan J.¶¶¶¶¶; Strandenes, Geir******†††††††; Spinella, Philip C.**‖‖‖‖‡‡‡‡‡‡

TRANEXAMSAV HASZNÁLATA

Shakur H, Roberts I, Bautista R, Caballero J, Coats T, Dewan Y, et al. **Effects of tranexamic acid on death, vascular occlusive events, and blood transfusion in trauma patients with significant haemorrhage (CRASH-2): a randomised, placebo-controlled trial.** Lancet. 2010;376(9734):23–32.

Roberts I, Shakur H, Afolabi A, Brohi K, Coats T, Dewan Y, et al**. The importance of early treatment with tranexamic acid in bleeding trauma patients: an exploratory analysis of the CRASH-2 randomised controlled trial.** Lancet. 2011;377(9771):1096–1101. 101 e1–2.]

VOLTAK FIATALJAINK AKIK FIGYELTEK ERRE MÁR 2009-BEN

FIATAL ORVOSOK FÓRUMA

A HM ÁEK Baleseti Sebészeti Osztály[1], OMSZ Légimentő Kht.[2] és az Országos Mentőszolgálat[3] közleménye

Permisszív hypotensio és új szemlélet a súlyos sérültek ellátásában, avagy merjünk ne adni…

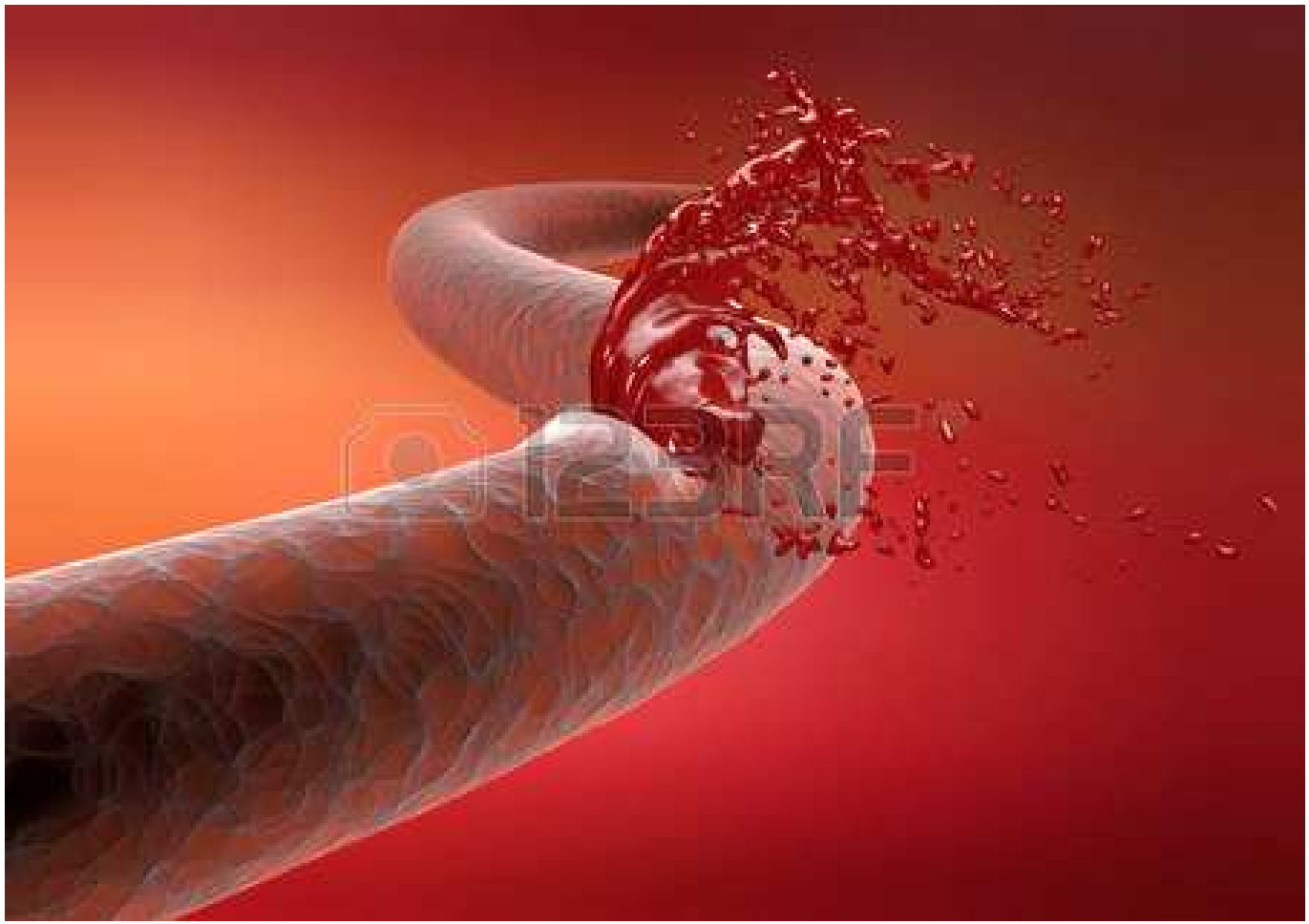
DR. HETZMAN T. LÁSZLÓ[1,2], DR. GOROVE LÁSZLÓ[2]

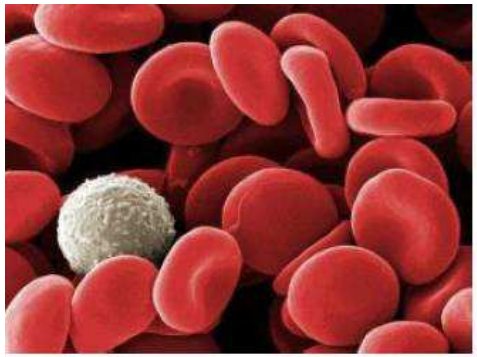
ÖSSZEFOGLALÁS

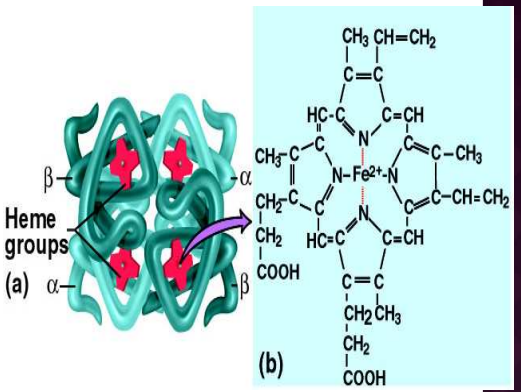
A permisszív hypotensio több mint 100 éve leírt fogalom. Alkalmazását definitív vérzéscsillapítás elvégzéséig javasolják, a további vérveszteség csökkentésére. Ezáltal rengeteg későbbi szövődménytől óvhatjuk meg a sérültet, gyakorlatilag a halálos triász mindegyik összetevője kedvezően befolyásolható. A módszernek komoly irodalmi háttere van, több sérültellátási protokoll részét képezi, azonban országunkban ismertsége sajnos igen csekély. Az eddig alkalmazott masszív folyadékpótlás pedig ebben a sérültcsoportban rendkívül káros. Jelen cikkben a módszer előnyeit és hátterét szeretnénk bemutatni.

Magyar Traumatológia Ortopédia Kézsebészet Plasztikai Sebészet 2009. 52. 3

FÓKUSZBAN A VÉRZÉSEK KEZELÉSE





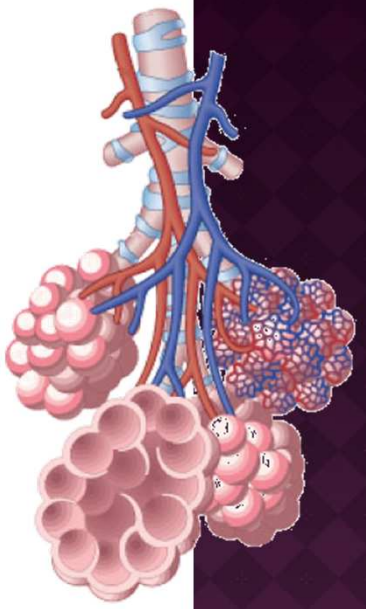


- A haemoglobin koncentrációja nagymértékben meghatározza a vér oxigénszállító-kapacitását (>98 %-os oxigénkötő-kapacitás kihasználtság).
- Egy hemoglobin (4 hem alegység, 1 mol hemoglobin 4 mol oxigént tud kötni)
- A vérben ténylegesen feloldott oxigén mennyisége a parciális nyomás és a pH függvénye
- A tüdőben uralkodó 13,4 kPa parciális oxigén nyomás (pH 7,4) mellett a hemoglobin gyakorlatilag 100%-ban telítve van oxigénnel. A szöveti környezetben viszont az oxigén parciális nyomása csupán 5,3 kPa, aminek következtében a vér oxigén telítettsége csak 65 %
- A kémiailag kötött oxigén mennyisége nagyobb, mint a fizikailag kötötté

A Fick-elv

$$VO_2 = (CO \times C_a) - (CO \times C_v)$$

$$CO = \frac{VO_2}{C_a - C_v}$$



CO = perctérfogat,
C_a = az artériás vér oxigéntartalma
C_v = kevert vénás vér oxigéntartalma
VO_2= tiszta gáz halmazállapotú oxigénfogyasztás ml-ben
DO_2= az O_2-szállítás

C_a (a vér oxigéntartalma) = Hgb(g/dl)× 1,34(mlO_2/g Hgb)× Sa O_2:100+0,0032 × PaO_2

$DO2 = CO \times CaO_2$ kb. 1000 ml/perc 100 % SaO_2 esetén
$VO2 = CO \times (CaO_2 - CvO_2)$ kb. 250 ml/perc

Az extraakció 0,3-1,0 VAN TARTALÉK!

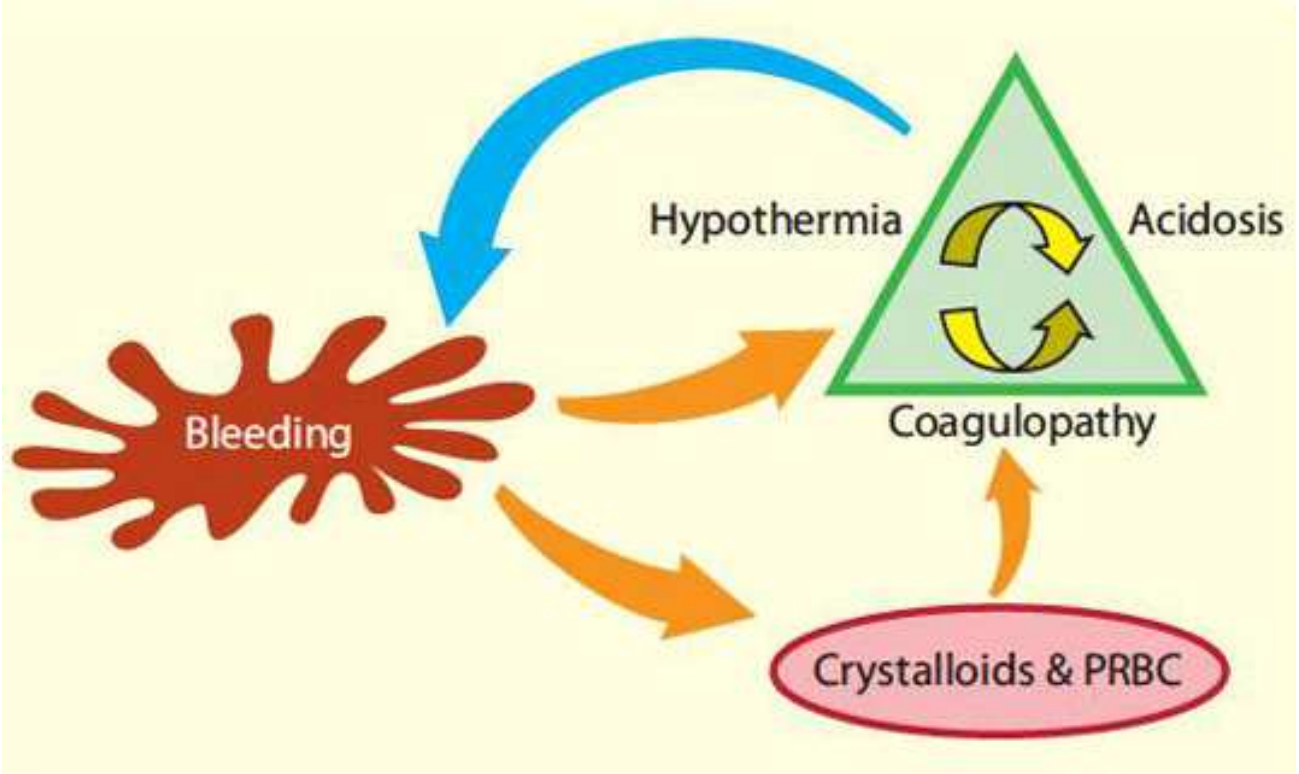
Kivérzett, hypovolémiás betegnél $VO_2 > DO_2$

MI OKOZ KÁRT/PROBLÉMÁT?

- The leading cause of death among trauma patients remains uncontrolled hemorrhage and accounts for approximately 30–40% of trauma related deaths. This technique places emphasis on preventing the" lethal triad " , rather than correcting the anatomy

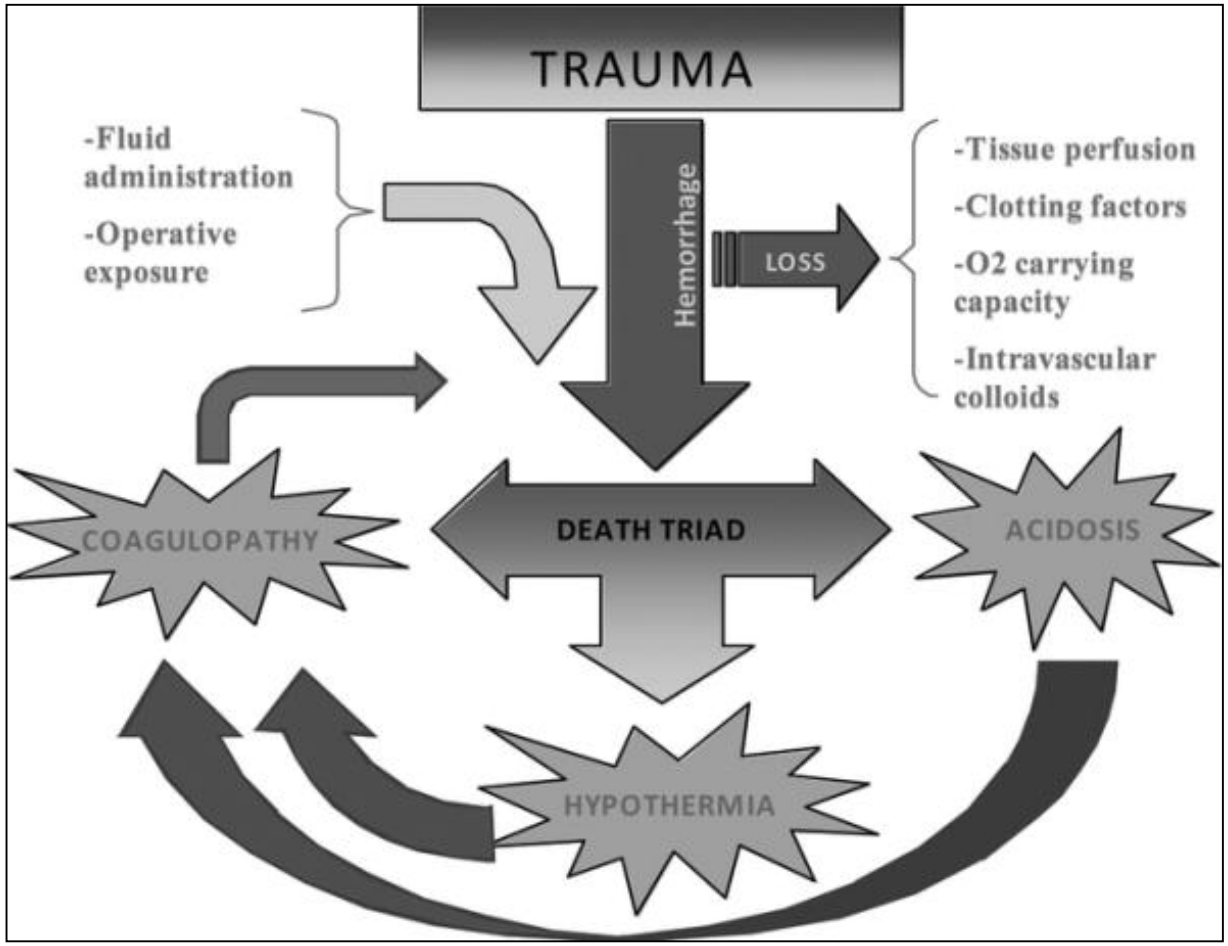
J Trauma2010 Oct;69(4):976-90. doi: 10.1097/TA.0b013e3181f2abc9.
Damage control resuscitation: the new face of damage control.

A HALÁLOS TRIÁSZ



M. Burch, V.B. Ortiz, R.J. Richardson, R.R.Martin, K.L. Mattox, G.L. Jordan Jr.**Abbreviated laparotomy and planned reoperation for critically injured patients**
Ann Surg, 215 (5) (**1992**), pp. 476-483

Figure 1.



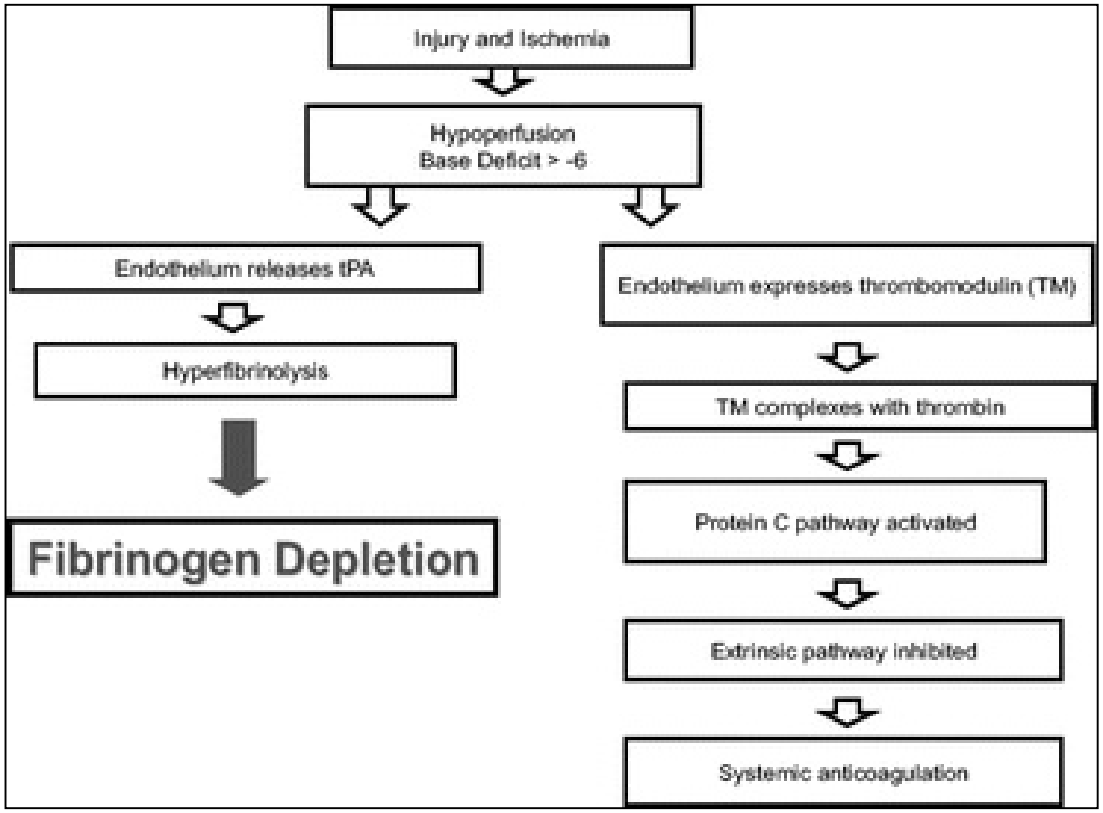
Damage Control Resuscitation: The New Face of Damage Control.

Duchesne, Juan; MD, FACS; McSwain, Norman; MD, FACS; Cotton, Bryan; MD, FACS; Hunt, John; MD, MPH; Dellavolpe, Jeff; Lafaro, Kelly; MD, MPH; Marr, Alan; MD, FACS; Gonzalez, Earnest; MD, FACS; Phelan, Herb; MD, FACS; Bilski, Tracy; MD, FACS; Greiffenstein, Patrick; Barbeau, James; MD, JD; Rennie, Kelly; Baker, Christopher; MD, FACS; Brohi, Karim; MD, FRCS; Jenkins, Donald; MD, FACS; Rotondo, Michael; MD, FACS

Journal of Trauma-Injury Infection & Critical Care.
69(4):976-990, October 2010.
DOI: 10.1097/TA.0b013e3181f2abc9

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

Figure 2.



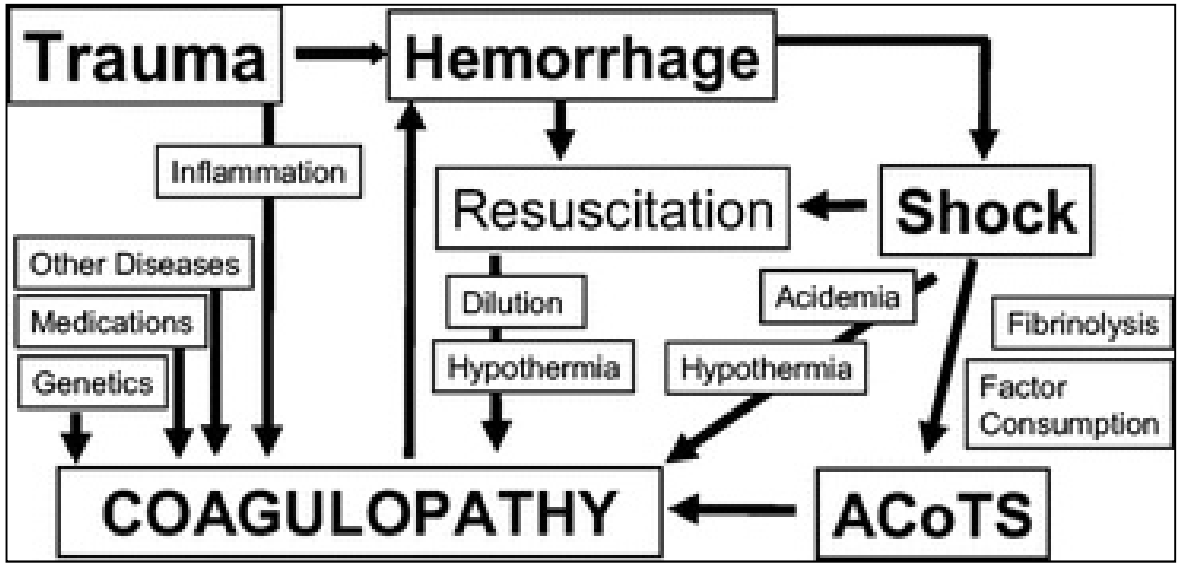
Damage Control Resuscitation: The New Face of Damage Control.

Duchesne, Juan; MD, FACS; McSwain, Norman; MD, FACS; Cotton, Bryan; MD, FACS; Hunt, John; MD, MPH; Dellavolpe, Jeff; Lafaro, Kelly; MD, MPH; Marr, Alan; MD, FACS; Gonzalez, Earnest; MD, FACS; Phelan, Herb; MD, FACS; Bilski, Tracy; MD, FACS; Greiffenstein, Patrick; Barbeau, James; MD, JD; Rennie, Kelly; Baker, Christopher; MD, FACS; Brohi, Karim; MD, FRCS; Jenkins, Donald; MD, FACS; Rotondo, Michael; MD, FACS

Journal of Trauma-Injury Infection & Critical Care.
69(4):976-990, October 2010.
DOI: 10.1097/TA.0b013e3181f2abc9

Figure 2. Trauma-induced coagulopathy.

Fig. 1.



The Coagulopathy of Trauma: A Review of Mechanisms.
Hess, John; MD, MPH; FACP, FAAAS; Brohi, Karim; Dutton, Richard; MD, MBA; Hauser, Carl; MD, FACS; Holcomb, John; MD, FACS; Kluger, Yoram; Mackway-Jones, Kevin; MD, FRCP; FRCS, FCEM; Parr, Michael; MB, BS; FRCP, FRCA; FANZCA, FJFICM; Rizoli, Sandro; MD, PhD; Yukioka, Tetsuo; Hoyt, David; MD, FACS; Bouillon, Bertil

Journal of Trauma-Injury Infection & Critical Care.
65(4):748-754, October 2008.
DOI: 10.1097/TA.0b013e3181877a9c

Fig. 1. A diagram showing some of the mechanisms leading to coagulopathy in the injured. Trauma can lead to hemorrhage which can lead to resuscitation, which in turn leads to dilution and hypothermia causing coagulopathy and further hemorrhage. This is classic "dilutional coagulopathy". Hemorrhage can also cause shock which causes acidosis and hypothermia that in turn lead to coagulopathy, the "fatal triad". Trauma and shock can also cause the Acute Coagulopathy of Trauma-Shock (ACoTS) associated with factor consumption and fibrinolysis. Coagulopathy is further associated with trauma-induced inflammation and modified by genetics, medications, and acquired diseases.

És már itt a 2016 ajánlás is

Coagulation monitoring

Recommendation 12 **We recommend that routine practice include the early and repeated monitoring of coagulation, using either a traditional laboratory determination [prothrombin time (PT), activated partial thromboplastin time (APTT) platelet counts and fibrinogen] (Grade 1A) and/or a viscoelastic method. (Grade 1C)**

Type of fluid

Recommendation 16 **We recommend that fluid therapy using isotonic crystalloid solutions be initiated in the hypotensive bleeding trauma patient. (Grade 1A)**

We suggest that excessive use of 0.9 % NaCl solution be avoided. (Grade 2C)

We recommend that hypotonic solutions such as Ringer's lactate be avoided in patients with severe head trauma. (Grade 1C)

We suggest that the use of colloids be restricted due to the adverse effects on haemostasis. (Grade 2C)

Rationale

IV. Rapid control of bleeding

Damage control surgery

Recommendation 19 **We recommend that damage control surgery be employed in the severely injured patient presenting with deep haemorrhagic shock, signs of ongoing bleeding and coagulopathy. (Grade 1B)**

Other factors that should trigger a damage control approach are severe coagulopathy, hypothermia, acidosis, inaccessible major anatomic injury, a need for time-consuming procedures or concomitant major injury outside the abdomen. (Grade 1C)

We recommend primary definitive surgical management in the haemodynamically stable patient and in the absence of any of the factors above. (Grade 1C)

Initial coagulation resuscitation

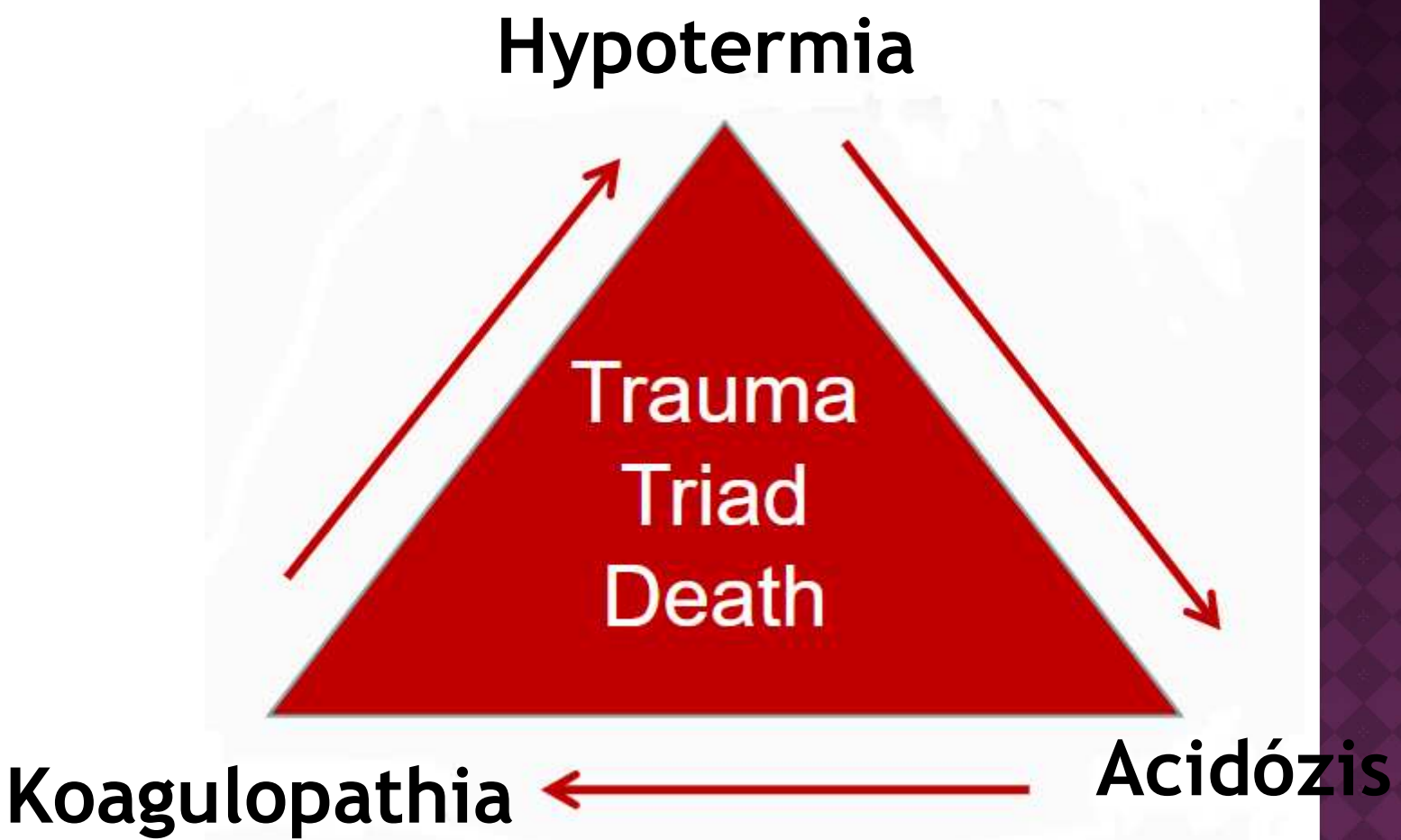
Recommendation 24 **In the initial management of patients with expected massive haemorrhage, we recommend one of the two following strategies:**

- Plasma (FFP or pathogen-inactivated plasma) in a plasma–RBC ratio of at least 1:2 as needed. (Grade 1B)
- Fibrinogen concentrate and RBC according to Hb level. (Grade 1C)

The European guideline on management of major bleeding and coagulopathy following trauma
R.Rossaint at al. Crit Care. 2016 Apr 12;20:100. doi: 10.1186/s13054-016-1265

MIT JELENTSEN NEKÜNK A DAMAGE CONTROL A NAPI GYAKORLATBAN?

PARADIGMAVÁLTÁST..


Hypotermia
Trauma
Triad
Death
Koagulopathia
Acidózis

HIPOTERMIA

Defined:

- Core Temp < 35C (95F)

Action :

- ↓ coagulation factors
- ↑ platelet dysfunction

Classification:

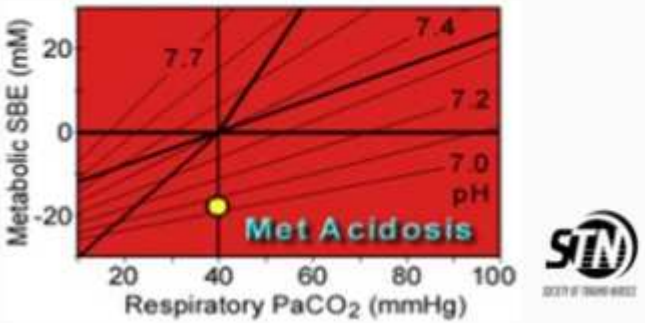
- Mod 32-34 C (90-93 F)
- Severe <32 C (< 90 F)
  T < 32C = 100% mortality

Moderate to Severe Hypo-thermia Occurs In <10% of Trauma

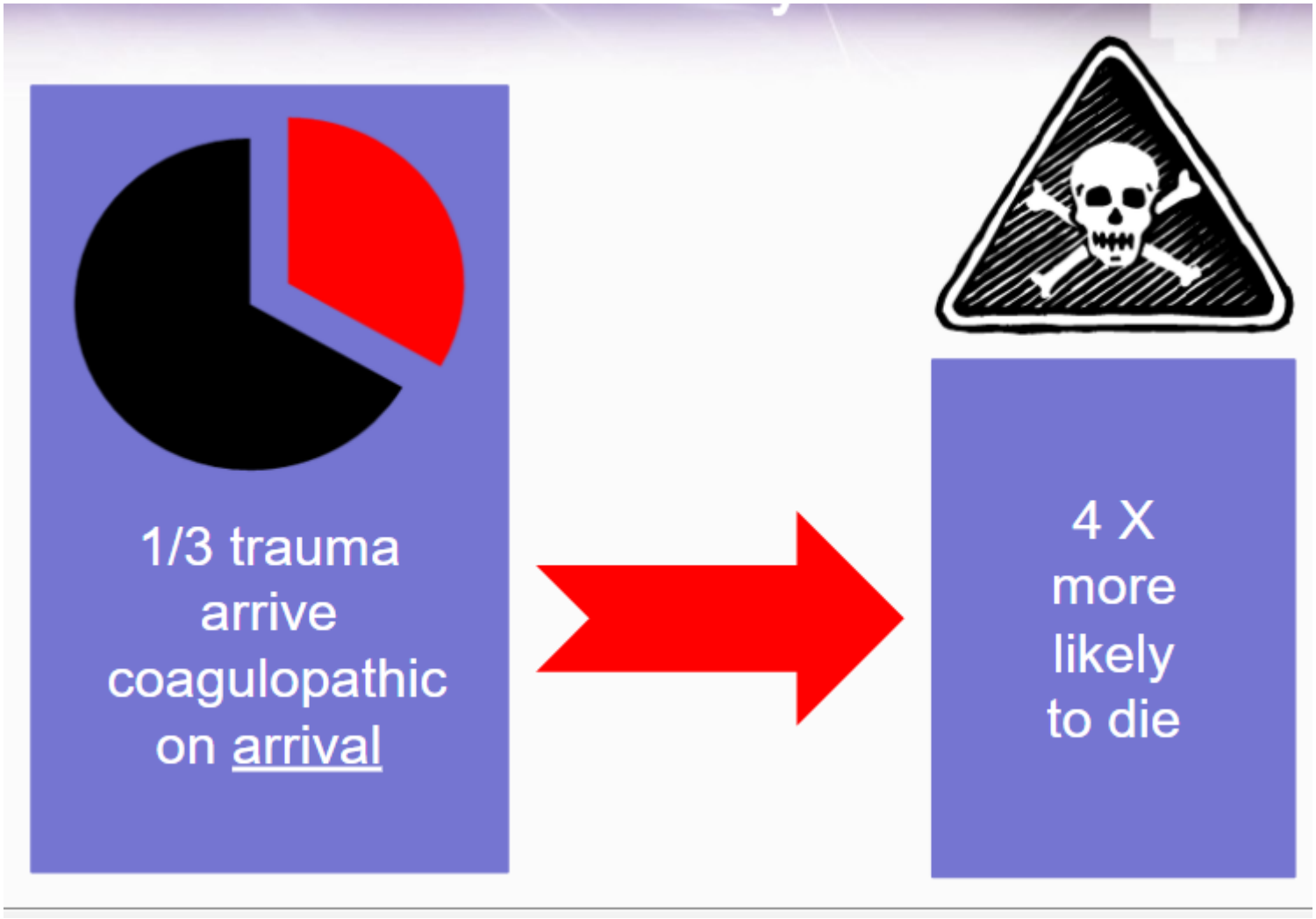
ACIDÓZIS

- **Effects:**
  - Altered hemostasis
  - Myocardial depression
- **Correlates with:**
  - Depth of shock
  - Degree of tissue injury
- **Assessed** :
  - pH
  - Base Deficit
  - Lactate

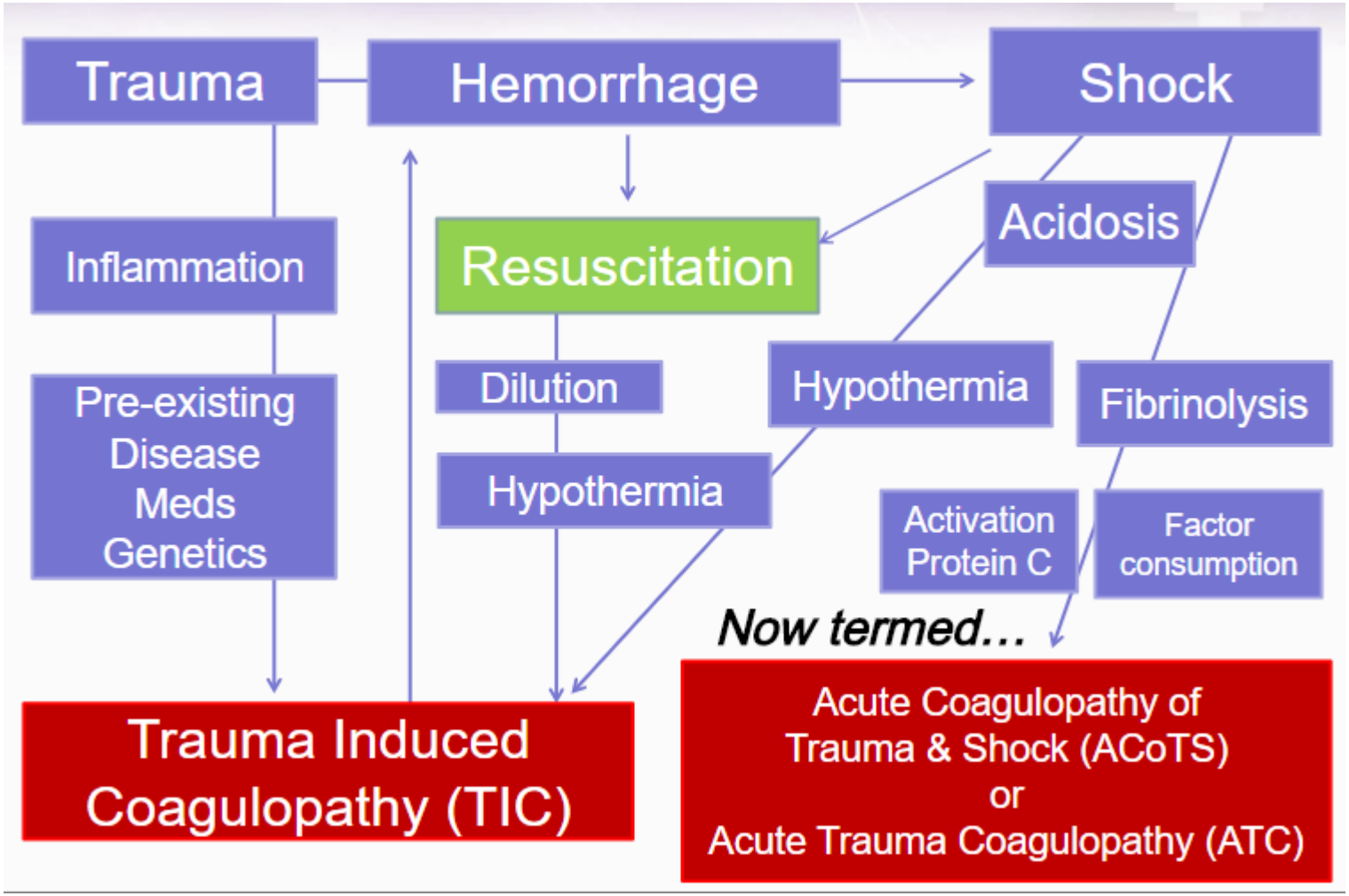
- **pH < 7.2**
- **Initial BD≥6**
  - Predicts transfusion
  - Increased ICU days
  - Risk for MSOF
- **Initial BD≥7.5**
  - ↑ mortality



NE FELEDJÜK !
A COAGULOPATHIA KORÁN ELKEZDŐDIK..



A TRAUMÁS COAGULOPATHIA TEÓRIÁJA



FOLYADÉK PÓTLÁS

Traditional Management	
Fluid	Blood
Give 2 Liters ↓ → Continue IV's wide open	PRBC 5-10 u ↓ Wait for labs ↓ Plasma ↓ Platelets

Emerging Management	
Fluid	Blood
Minimize	1:1 or 1:2 (Plasma: RBC) Protocolize ↓ Massive Transfusion Protocol

PARADIGMA VÁLTÁS MÉG EGYSZER

ATLS:

After 20 years of high volume fluid resuscitation

Chasing tachycardia

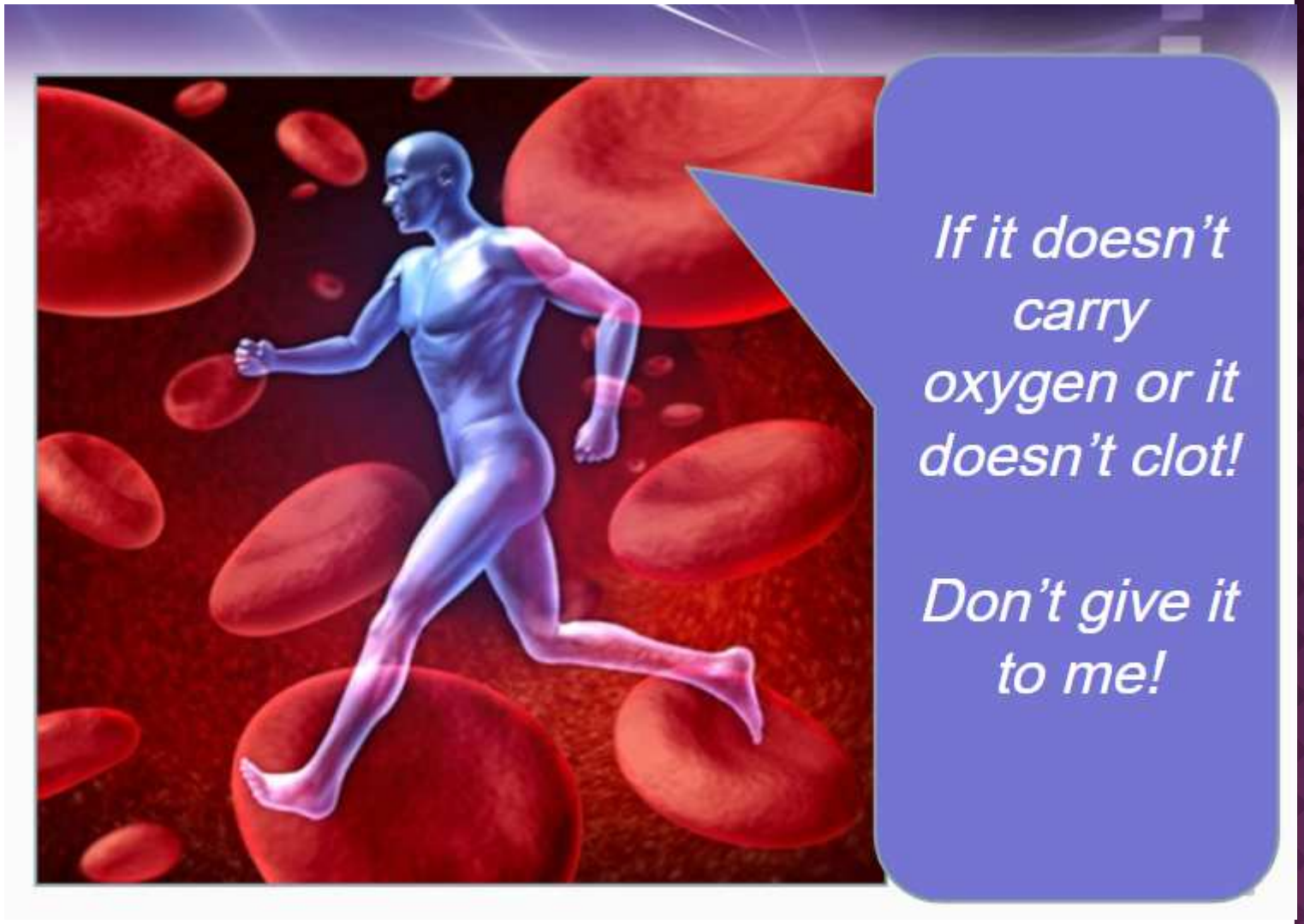
Using Crystalloid > Blood

Little evidence of improved survival

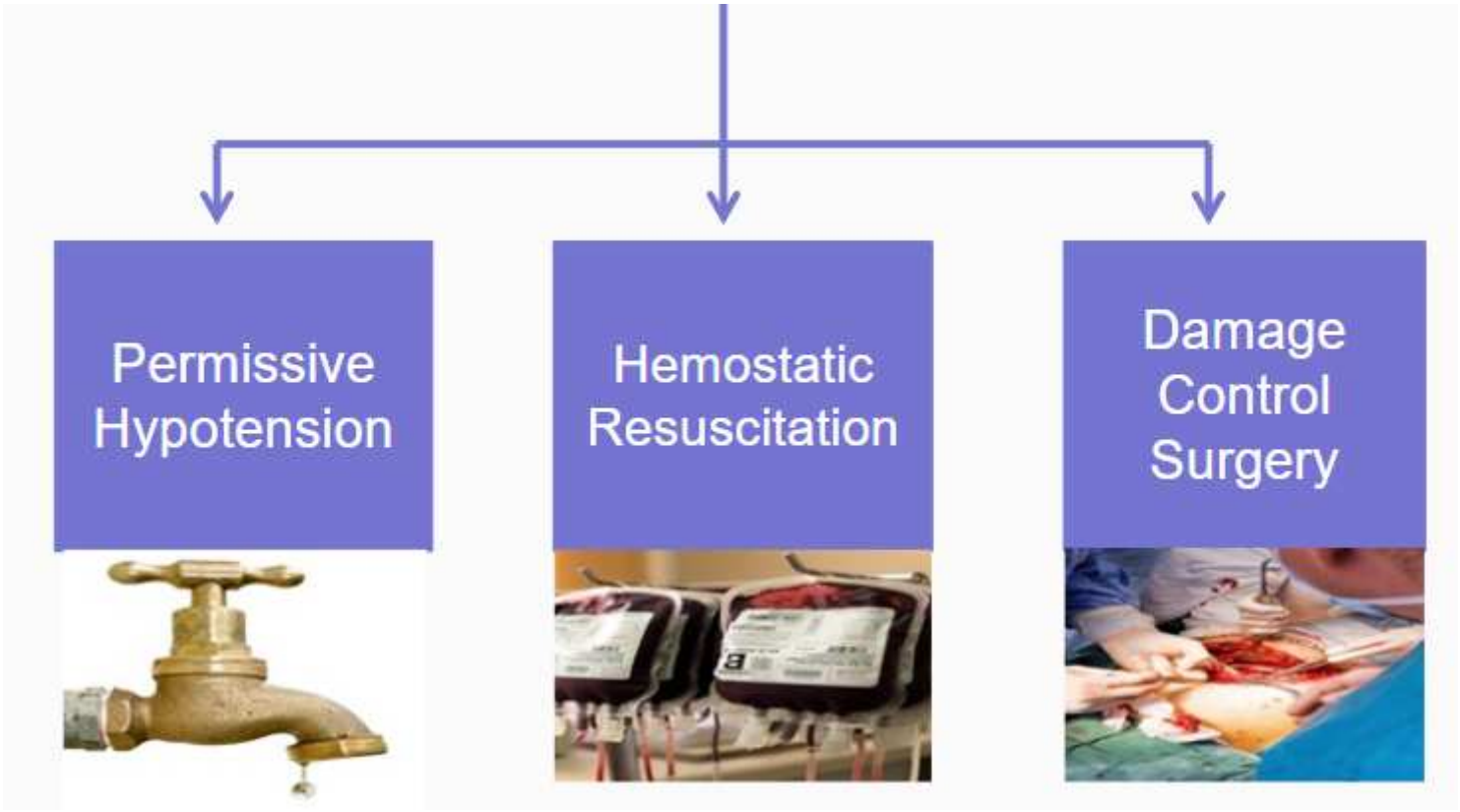
Current consensus:

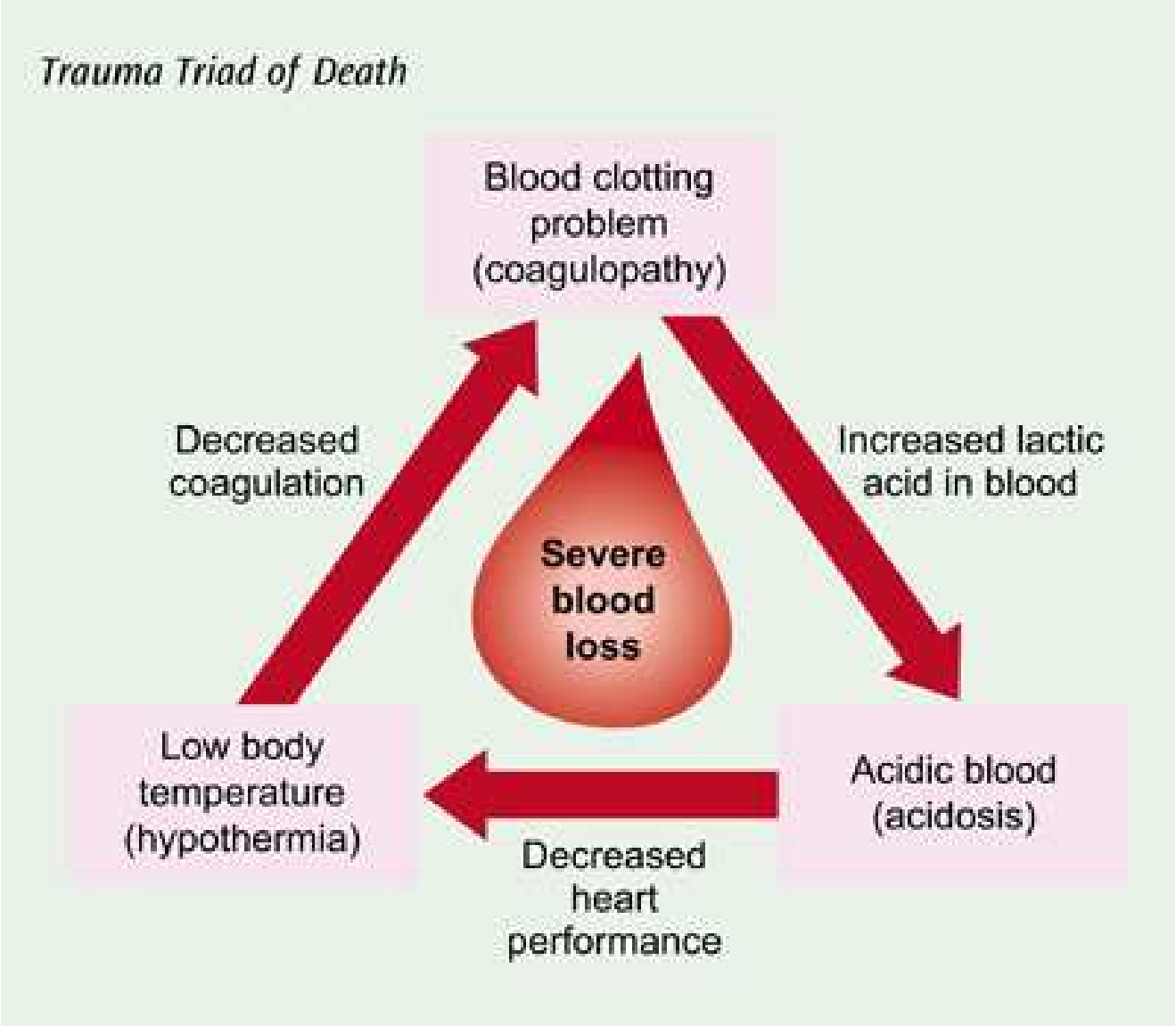
Damage Control Resuscitation

- Permissive Hypotension
- Hemostatic Resuscitation
- Damage Control Surgery


If it doesn't carry oxygen or it doesn't clot!
Don't give it to me!

DAMAGE CONTROL RESUSCITATION




Trauma Triad of Death
Blood clotting problem (coagulopathy)
Decreased coagulation
Increased lactic acid in blood
Severe blood loss
Low body temperature (hypothermia)
Acidic blood (acidosis)
Decreased heart performance

MIT VIGYÜNK HAZA?

- Előzzük meg a halálos tiászt
- Melegítsük/ne hagyjuk kihűlni a betegeinket
- Törekedjünk az acidózis elkerülésé
  - Laktátmérés ,BE,
- Rendezzük az oxygénadósságot
- Alkalmazzunk ésszerű folyadékpótlá
- Kontroláljuk a koagulációt,mérjük a fibrinogénszintet
- Időben adjunk tranexamsavat
- Legyen masszív transzfúziós protokollunk

Köszönöm a megtisztelő figyelmüket!