Gemelli

Fondazione Policlinico Universitario A. Gemelli
Università Cattolica del Sacro Cuore

Siset
Training Center
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Roma

SISET
SOCIETA' ITALIANA
PER LO STUDIO
DELL'EMOSTASI E
DELLA TROMBOSI

Linee guida per la gestione delle emergenze emorragiche nel paziente critico

The NEW ENGLAND JOURNAL of MEDICINE

REVIEW ARTICLE

CRITICAL CARE MEDICINE

Bleeding and Coagulopathies in Critical Care

Beverley J. Hunt, M.D.

EJA

Eur J Anaesthesiol 2013; **30**:270–382

GUIDELINES

Management of severe perioperative bleeding

Guidelines from the European Society of Anaesthesiology

Sibylle A. Kozek-Langenecker, Arash Afshari, Pierre Albaladejo, Cesar Aldecoa Alvarez Santullano, Edoardo De Robertis, Daniela C. Filipescu, Dietmar Fries, Klaus Görlinger, Thorsten Haas, Georgina Imberger, Matthias Jacob, Marcus Lancé, Juan Llau, Sue Mallett, Jens Meier, Niels Rahe-Meyer, Charles Marc Samama, Andrew Smith, Cristina Solomon, Philippe Van der Linden, Anne Juul Wikkelsø, Patrick Wouters and Piet Wyffels

SIAARTI

PRO VITA CONTRA DOLOREM SEMPER

Rossaint *et al. Critical Care* (2016) 20:100
DOI 10.1186/s13054-016-1265-x

Critical Care

RESEARCH Open Access

The European guideline on management of major bleeding and coagulopathy following trauma: fourth edition

Rolf Rossaint[1], Bertil Bouillon[2], Vladimir Cerny[3,4,5,6], Timothy J. Coats[7], Jacques Duranteau[8], Enrique Fernández-Mondéjar[9], Daniela Filipescu[10], Beverley J. Hunt[11], Radko Komadina[12], Giuseppe Nardi[13], Edmund A. M. Neugebauer[14], Yves Ozier[15], Louis Riddez[16], Arthur Schultz[17], Jean-Louis Vincent[18] and Donat R. Spahn[19*]

Published in final edited form as:

Curr Opin Anaesthesiol. 2015 April ; 28(2): 227–236. doi:10.1097/ACO.0000000000000163.

The Coagulopathy of Acute Sepsis

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Jeff Simmons: jwsimmons@uabmc.edu; Jean-Francois Pittet: pittetj@uab.edu

Standards clinici per il Patient Blood Management e per il management della coagulazione e dell'emostasi nel perioperatorio

Position paper della Società Italiana di Anestesia, Analgesia, Rianimazione e Terapia Intensiva (SIAARTI)

Cinnella G*, Pavesi M°, De Gasperi A^, Ranucci M§, Mirabella L*

SIGO AOGOI AGUI

GESTIONE MULTIDISCIPLINARE DELL'EMORRAGIA POST-PARTUM

ALGORITMO

The NEW ENGLAND JOURNAL of MEDICINE

REVIEW ARTICLE

CRITICAL CARE MEDICINE

Bleeding and Coagulopathies in Critical Care

Beverley J. Hunt, M.D

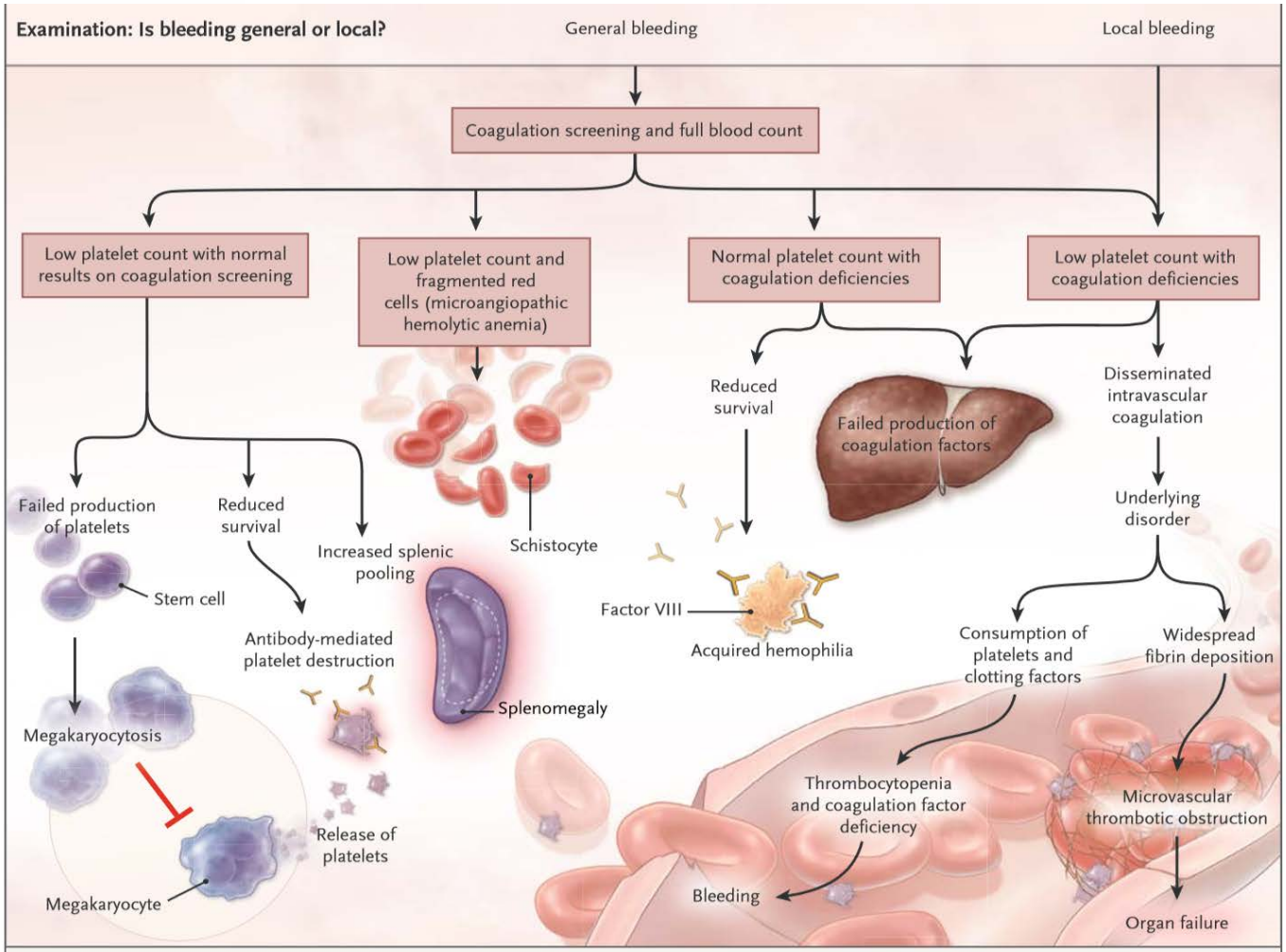


Figure 1. Causes of Bleeding among Patients in the ICU.

After the presence of inherited disorders and the use of antithrombotic drugs have been ruled out, the first major question ("Is the bleeding general or local?"), combined with a platelet count and coagulation screening, will assist in the identification of the pathogenesis of bleeding.

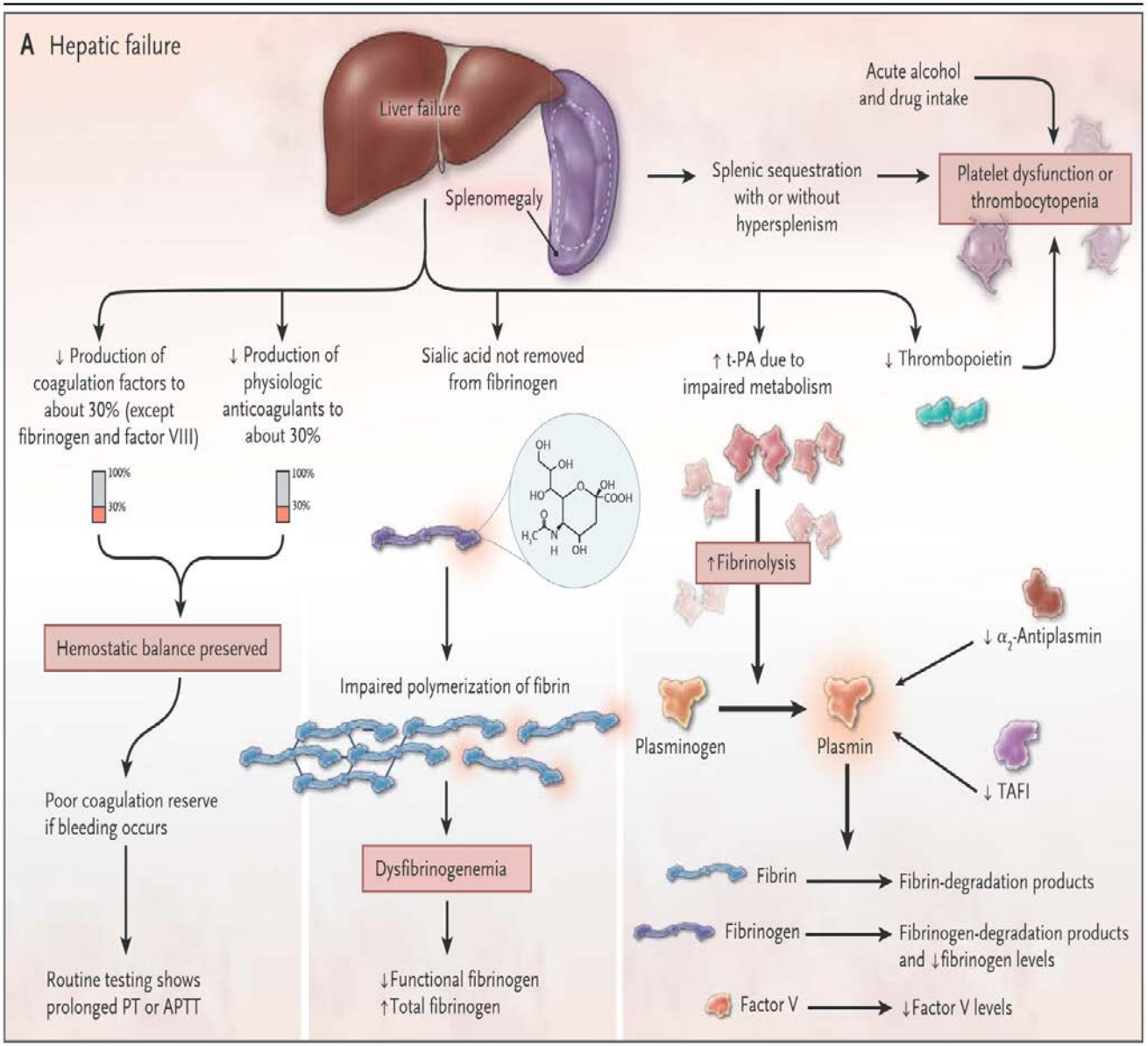
Major Bleeding

Fibrinogen is a critical molecule in coagulation
It forms fibrin
It is the ligand for platelet aggregation
In patients with major bleeding, it is required to a larger extent than any other hemostatic protein
This requirement reflects increased consumption, loss, dilution, and fibrinogenolysis

The trigger level for supplementing fibrinogen should be 1.5 to 2.0 g per liter

It is unknown whether early fibrinogen supplementation and the use of prothrombin complex concentrate, as compared with the use of fresh-frozen plasma, improves clinical outcomes in patients with major bleeding

Liver Disease



No need to treat prolonged coagulation times in the absence of bleeding

If bleeding does occur in liver disease, it is recommend blood component management as determined by the results of testing of the platelet count, prothrombin time, activated partial-thromboplastin time, thrombin time, and fibrinogen

Renal Disease

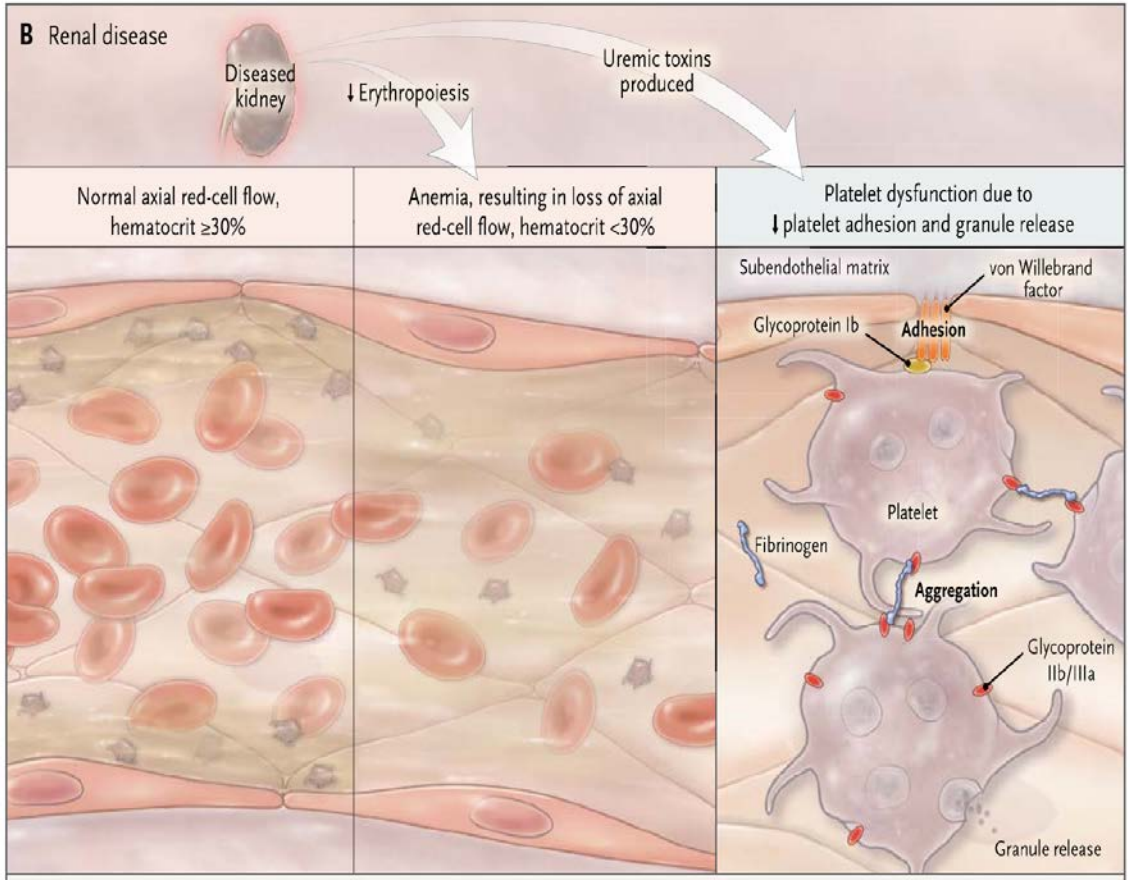


Figure 3. Hemostasis in Hepatic Failure and Renal Disease.

Liver failure (Panel A) leads to complex hemostatic changes, since the liver is the producer of coagulation factors, physiologic anticoagulants, and thrombopoietin, as well as the site of the metabolism of sialic acid residues from fibrinogen, activated coagulation factors, and tissue plasminogen activator. These defects result in poor coagulation reserve, dysfibrinogenemia, and increased fibrinolytic potential. In renal failure (Panel B), decreased production of erythropoietin produces anemia, which results in a loss of axial flow so that the bleeding time is prolonged. The accumulation of uremic toxins results in platelet dysfunction. APTT denotes activated partial-thromboplastin time, PT prothrombin time, TAFI thrombin-activatable fibrinolysis inhibitor, and t-PA tissue plasminogen activator.

Uremic bleeding typically presents with ecchymoses, purpura, epistaxis, and bleeding from puncture sites due to impaired platelet function

The platelet dysfunction is a result of complex changes that include **dysfunctional von Willebrand factor, decreased production of thromboxane, increased levels of cyclic AMP and c yclic GMP, uremic toxins, anemia, and altered platelet granules,** all of which are necessary for adequate formation of a platelet plug. The **anemia** that commonly accompanies renal disease leads to the loss of laminar flow in arterioles so that red cells no longer push platelets and plasma to the endothelium, leading to prolongation of the bleeding time; **treatment of the anemia partially corrects this problem.** There is also some evidence of **impaired fibrinolysis** in patients with renal disease.

Fibrinolytic Bleeding

Bleeding continues despite hemostatic replacement therapy

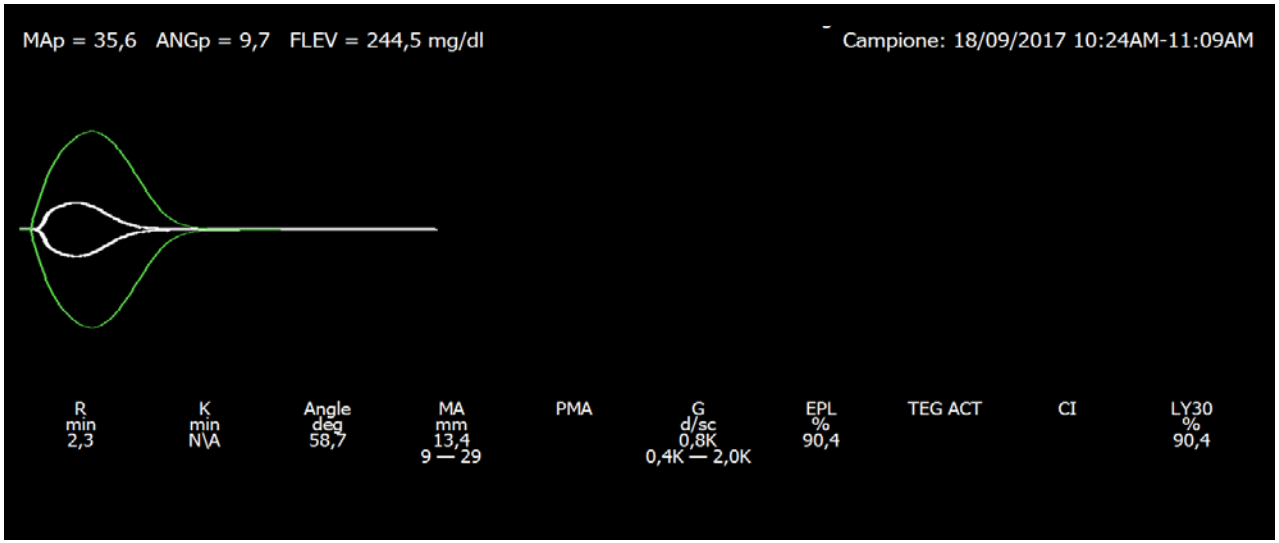
Platelet levels are relatively conserved

Fibrinogen levels are disproportionately low

D-dimer levels are disproportionately high for disseminated intravascular coagulation

Thromboelastography, which may help differentiate fibrinolytic activation from coagulation factor deficiency, is a crude tool, since it detects only the most marked changes

The use of tranexamic acid, either by infusion or orally (depending on the severity of the problem and the state of the patient), is beneficial in controlling bleeding.



Von Willebrand's Disease

Acquired von Willebrand's disease, can be caused by several potential mechanisms due to autoantibodies, myeloproliferative and lymphoproliferative proliferative disorders the breakdown of highmolecular-weight von Willebrand factor multimers owing to high intravascular or extracorporeal circuit shear stresses

Acquired von Willebrand's disease is treated with the use of either desmopressin, which stimulates the release of residual stores of von Willebrand factor by endothelial cells, or von Willebrand factor concentrates, with the latter considered to be the more effective therapy The use of antifibrinolytic agents may be considered to alleviate mucocutaneous bleeding

Bleeding Associated with Antithrombotic Therapy

Table 4. Common Antithrombotic Agents, Mechanisms of Action, and Reversibility.

Agent	Mechanism of Action	Site of Clearance	Half-Life	Procedure for Immediate Reversal
Aspirin	Irreversible cyclooxygenase inhibitor		20 min but effect will persist for 5 days	Platelet transfusion; consider use of desmopressin
Clopidogrel, prasugrel, ticagrelor	$P2Y_{12}$ antagonists	Hepatic	6 to 15 hr	Platelet transfusion
Unfractionated heparin	Indirect anti-Xa and anti-IIa effect; increases the action of antithrombin by factor of 10,000	Cellular and (at higher doses) renal	45–90 min	Protamine (at a dose of 1 mg) neutralizes 80–100 U unfractionated heparin
Low-molecular-weight heparin	Same as for unfractionated heparin but mainly anti-Xa effect	Renal	Approximately 4 hr, with variability among products	Protamine reverses 60% of effect; consider the use of recombinant activated factor VII if there is continued life-threatening bleeding and the time frame suggests there is residual effect
Danaparoid	A heparinoid with ratio of anti-Xa to anti-IIa of >20	Renal	24 hr	No specific antidote; plasmapheresis may be considered for critical bleeding
Fondaparinux	Synthetic pentasaccharide with indirect anti-Xa effect	Renal	17–20 hr	No specific antidote; use of recombinant activated factor VII should be considered for critical bleeding
Bivalirudin	Direct antithrombin effect	Proteolysis by thrombin (80%) with 20% renal excretion	25 min; 1 hr in renal failure	No specific antidote; hemodialysis, hemofiltration, or plasmapheresis may be considered for critical bleeding
Argatroban	Direct thrombin inhibitor	Hepatic	45 min	No specific antidote
Vitamin K antagonists (e.g., warfarin, phenprocoumon, acenocoumarol, phenindione)	Reduction in functional levels of vitamin K–dependent clotting factors (II, VII, IX, and X)	Hepatic	Varies according to drug, with phenprocoumon the longest and acenocoumarol the shortest	Intravenous vitamin K (1 to 5 mg) and prothrombin complex concentrate (25 to 50 U/kg); use of fresh frozen plasma only if prothrombin complex concentrate is not available
Dabigatran	A direct thrombin inhibitor	80% renal	13 hr (range, 11–22 hr); with creatinine clearance <30 ml/min, 22–35 hr	No specific antidote; use of oral activated charcoal if administered within 2 hr after receipt of drug; consider hemofiltration, hemodialysis; if life-threatening bleeding, consider prothrombin complex concentrate, activated prothrombin complex concentrate, and recombinant activated factor VII
Rivaroxaban, apixaban, edoxaban	Direct anti-Xa inhibition	Hepatic and renal	Rivaroxaban, 7–9 hr; apixaban, 9–14 hr	No specific antidote; if life-threatening bleeding, same as for dabigatran

Sepsis is defined by the presence of

Host response — Inflammation — Infection

Disturbances in coagulation

Coagulopathy of Acute Sepsis (CAS)

Thrombosis → Thromboembolic Disease
Microvascular Fibrin Deposition

Hemorrhage → DIC: Disseminated Intravascular Coagulation

Microvascular Fibrin Deposition

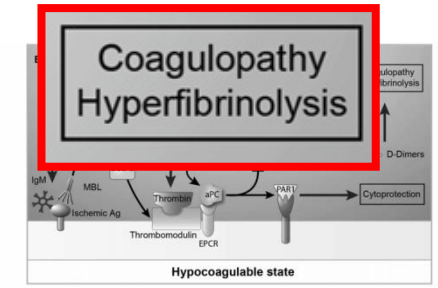


Fig. 1. Early post-traumatic phase. Tissue trauma and shock with systemic hypoperfusion appear to be the primary factors responsible for the development of acute traumatic coagulopathy in the immediate post-injury phase. As a result of overt activation of protein C pathway, the acute traumatic coagulopathy is characterised by *coagulopathy* (de-activation of the coagulation factors Va and VIIIa) in conjunction with *hyperfibrinolysis* (de-repression of fibrinolysis). In addition to its anticoagulant effects, activated protein C proteolytically activates the cell surface receptor, protease-activated receptor-1 (PAR-1), to produce several *cytoprotective* effects including anti-inflammatory properties, anti-apoptotic activity and protection of endothelial barrier function, all being required for acute survival during shock. The complement cascade is being activated immediately after trauma via the lectin pathway (mannose binding lectin, MBL), amplified via the alternative pathway and seems to be implicated in the activation of the protein C pathway early after severe trauma.

Fase precoce
Acute traumatic coagulopathy

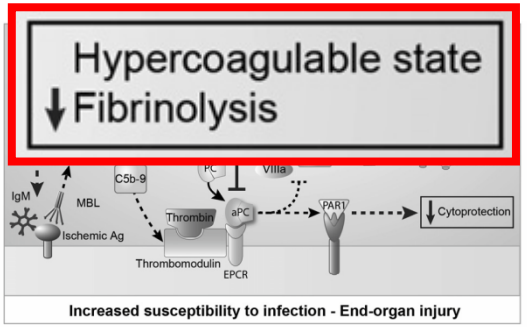


Fig. 2. Late post-traumatic phase. In the later phase after trauma, there is the development of a pro-coagulant activity associated with low plasma levels of activated protein C (aPC), an inhibition of the fibrinolysis caused by elevated plasma levels of plasminogen activator inhibitor 1 (PAI-1) and a downregulation of complement activation due to low plasma levels of mannose-binding lectins (MBL) and significant impairment of C3b deposition via the lectin and alternative pathways. These coagulation and complement abnormalities increase the susceptibility to hypercoagulability with late thrombosis, infection and end-organ injury. At the later time points the dashed lines represent inhibited or depleted pathways.

Fase tardiva
Traumatic coagulopathy

Trauma is characterised by the presence of

SHOCK-IPOPERFUSIONE ⟷ COAGULOPATIA

Systemic Acquired Coagulopathy (SAC)

Endogenous Acute Coagulopathy (EAC)
Or
Acute Coagulopathy of Trauma–Shock (ACoTS)

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The Coagulopathy of Acute Sepsis

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Best Practice & Research Clinical Anaesthesiology 24 (2010) 15–25

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journal homepage: www.elsevier.com/locate/bean

2

New insights into acute coagulopathy in trauma patients

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Johansson et al. Critical Care (2017) 21:25
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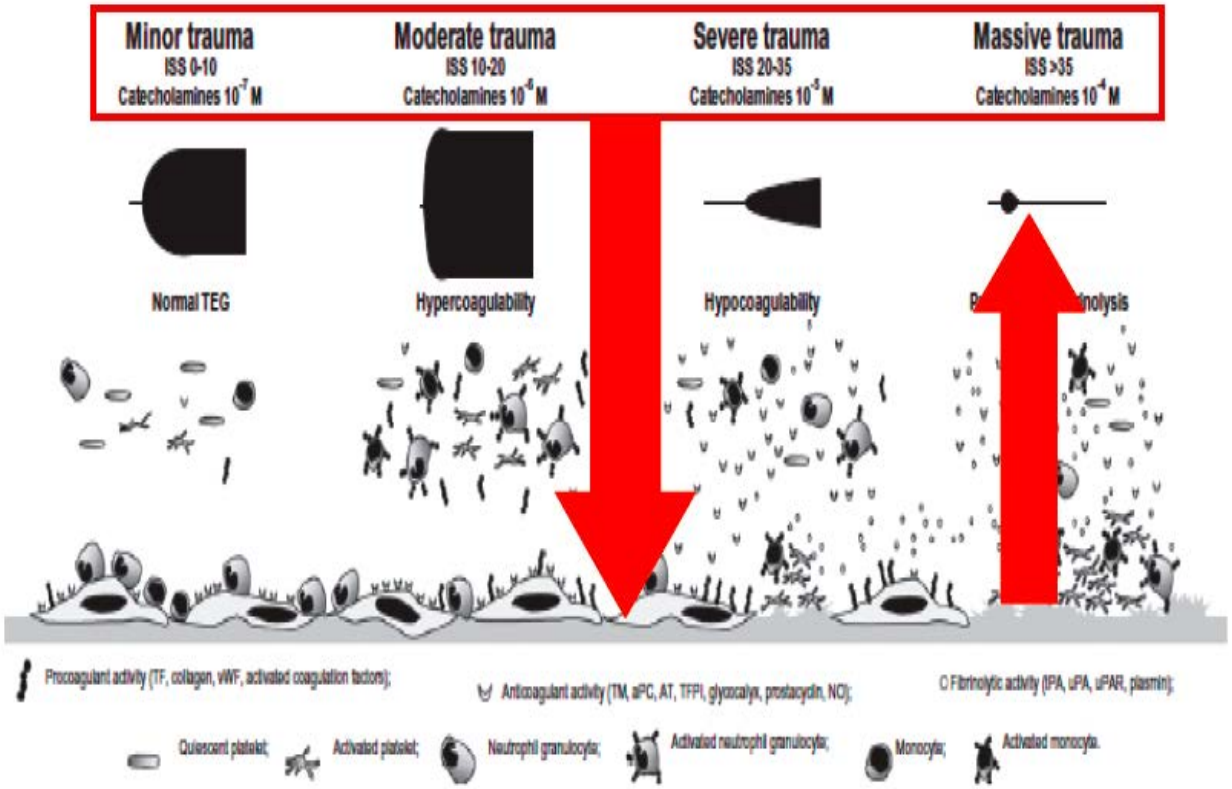
Critical Care

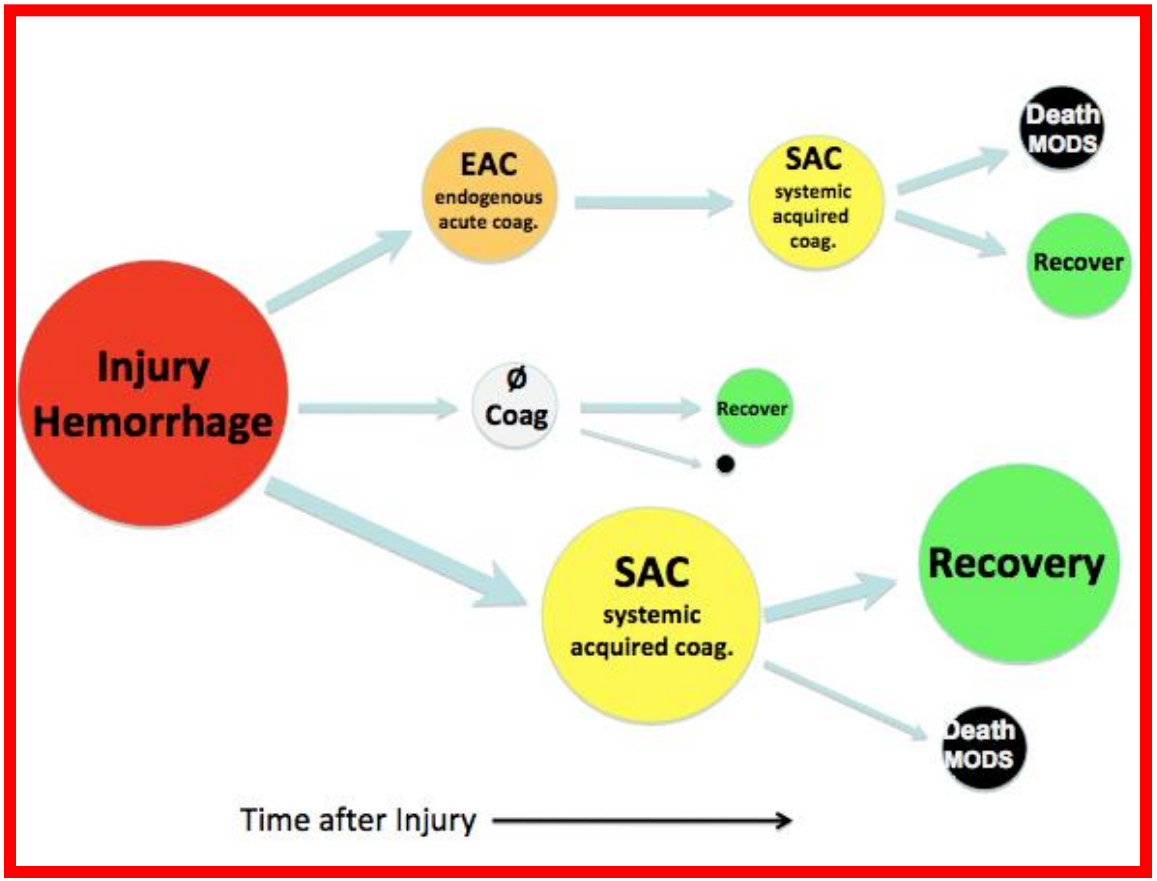
REVIEW Open Access

Shock induced endotheliopathy (SHINE) in acute critical illness - a unifying pathophysiologic mechanism

Pär Ingemar Johansson[1,2,3*], Jakob Stensballe[1,4] and Sisse Rye Ostrowski[1]



Acute Traumatic Coagulopathy: From Endogenous Acute Coagulopathy to Systemic Acquired Coagulopathy and Back

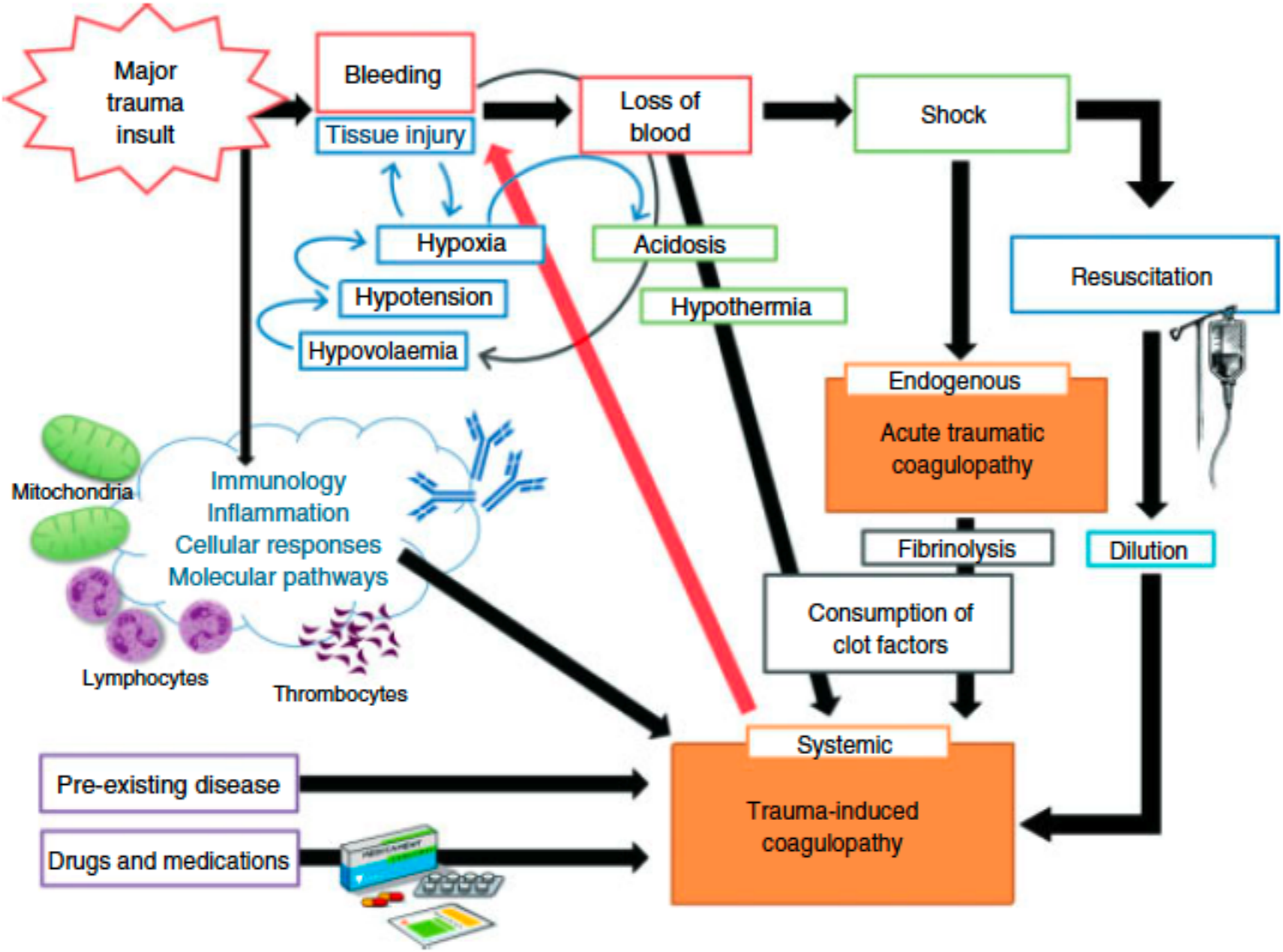


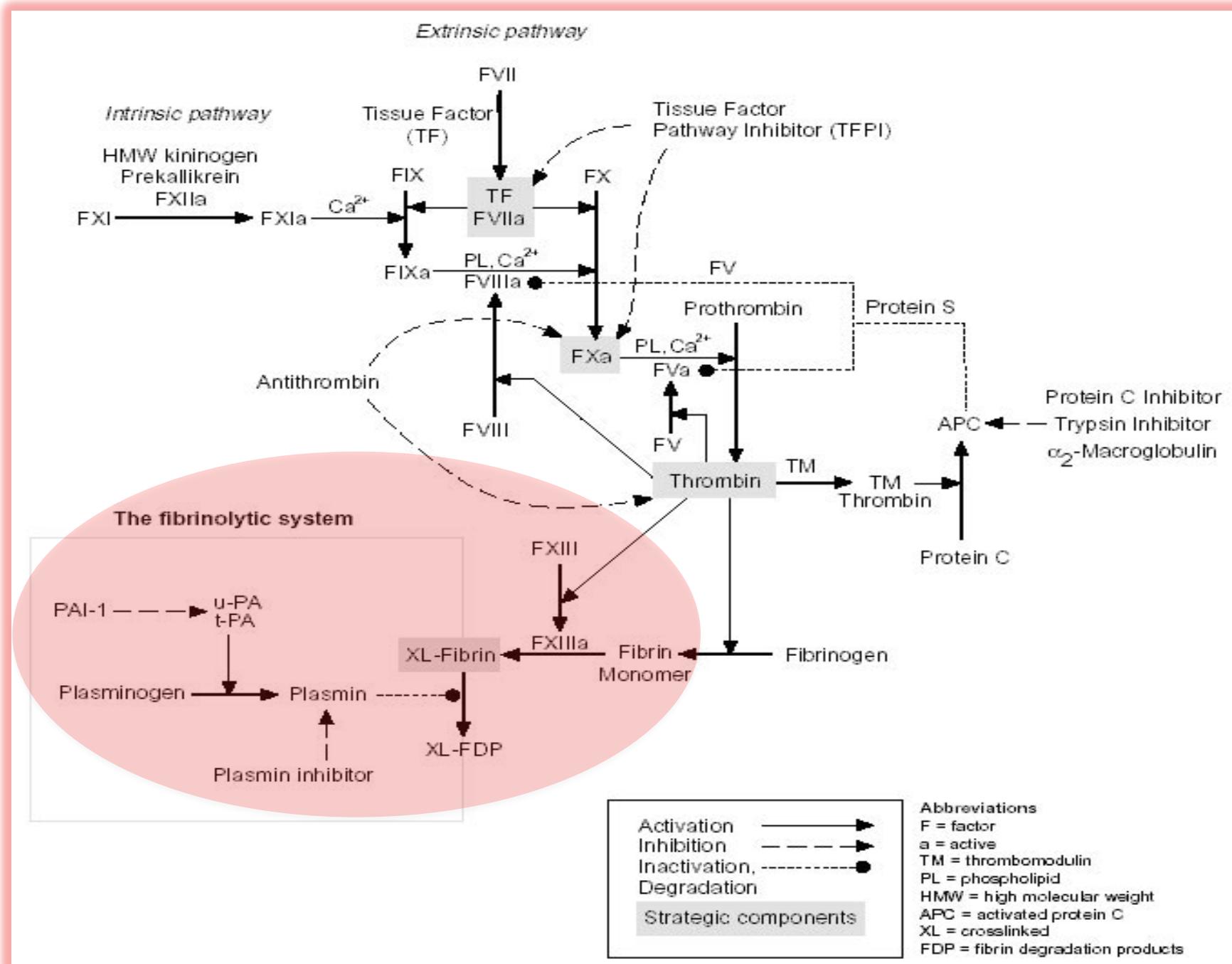
PATHOPHYSIOLOGICAL HYPOTHESIS

1. DIC with fibrinolytic phenotype

2. Neurormonal response

3. Anticoagulation and hyperfibrinolysis


Major trauma insult
Bleeding
Tissue injury
Loss of blood
Shock
Hypoxia
Acidosis
Hypothermia
Hypotension
Hypovolaemia
Resuscitation
Endogenous
Acute traumatic coagulopathy
Mitochondria
Immunology
Inflammation
Cellular responses
Molecular pathways
Lymphocytes
Thrombocytes
Fibrinolysis
Dilution
Consumption of clot factors
Systemic
Trauma-induced coagulopathy
Pre-existing disease
Drugs and medications


Extrinsic pathway
FVII
Intrinsic pathway
Tissue Factor (TF)
Tissue Factor Pathway Inhibitor (TFPI)
HMW kininogen
Prekallikrein
FXIIa
FXI
FXIa
Ca2+
FIX
TF
FVIIa
FX
FIXa
PL, Ca2+
FVIIIa
FV
Prothrombin
Protein S
FXa
PL, Ca2+
FVa
Antithrombin
FVIII
FV
Protein C Inhibitor
Trypsin Inhibitor
α2-Macroglobulin
APC
Thrombin
TM
TM Thrombin
Protein C
The fibrinolytic system
FXIII
PAI-1
u-PA
t-PA
FXIIIa
XL-Fibrin
Fibrin Monomer
Fibrinogen
Plasminogen
Plasmin
XL-FDP
Plasmin inhibitor
Activation
Inhibition
Inactivation, Degradation
Strategic components
Abbreviations
F = factor
a = active
TM = thrombomodulin
PL = phospholipid
HMW = high molecular weight
APC = activated protein C
XL = crosslinked
FDP = fibrin degradation products

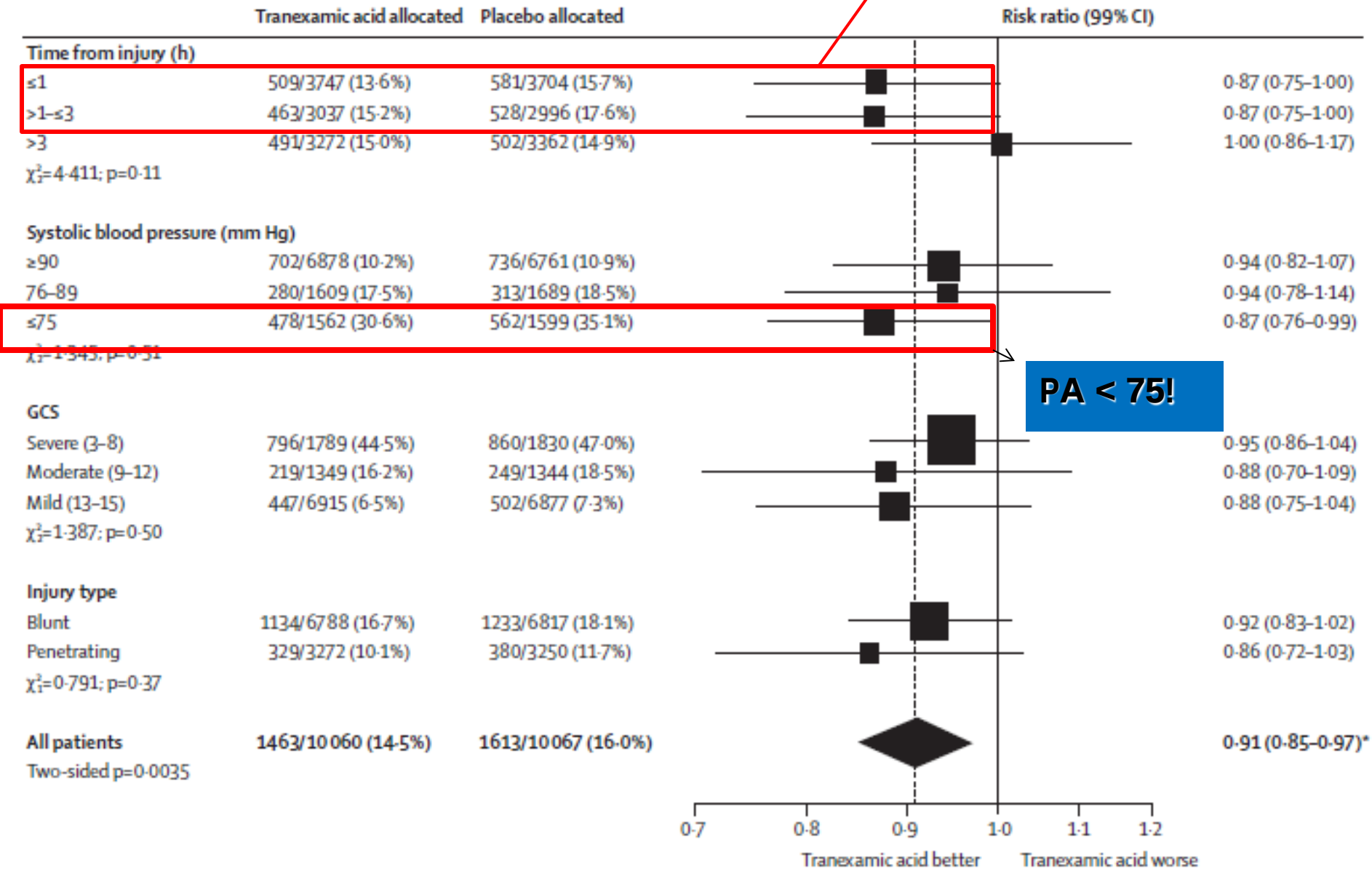
HYPERFIBRINOLYSIS

AND

FIBRINOLYTIC ACTIVITY

CRASH-2

Presto !

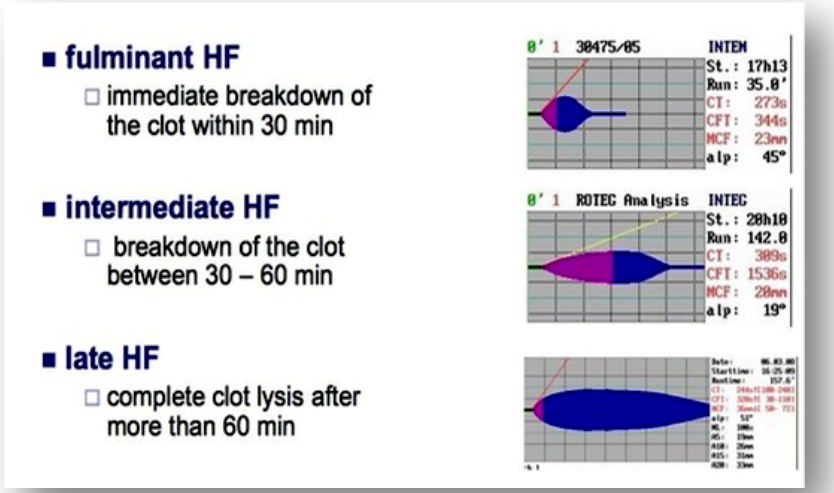


Hyperfibrinolysis After Major Trauma: Differential Diagnosis of Lysis Patterns and Prognostic Value of Thrombelastometry

Schöchl H: J Trauma 2009;67:125

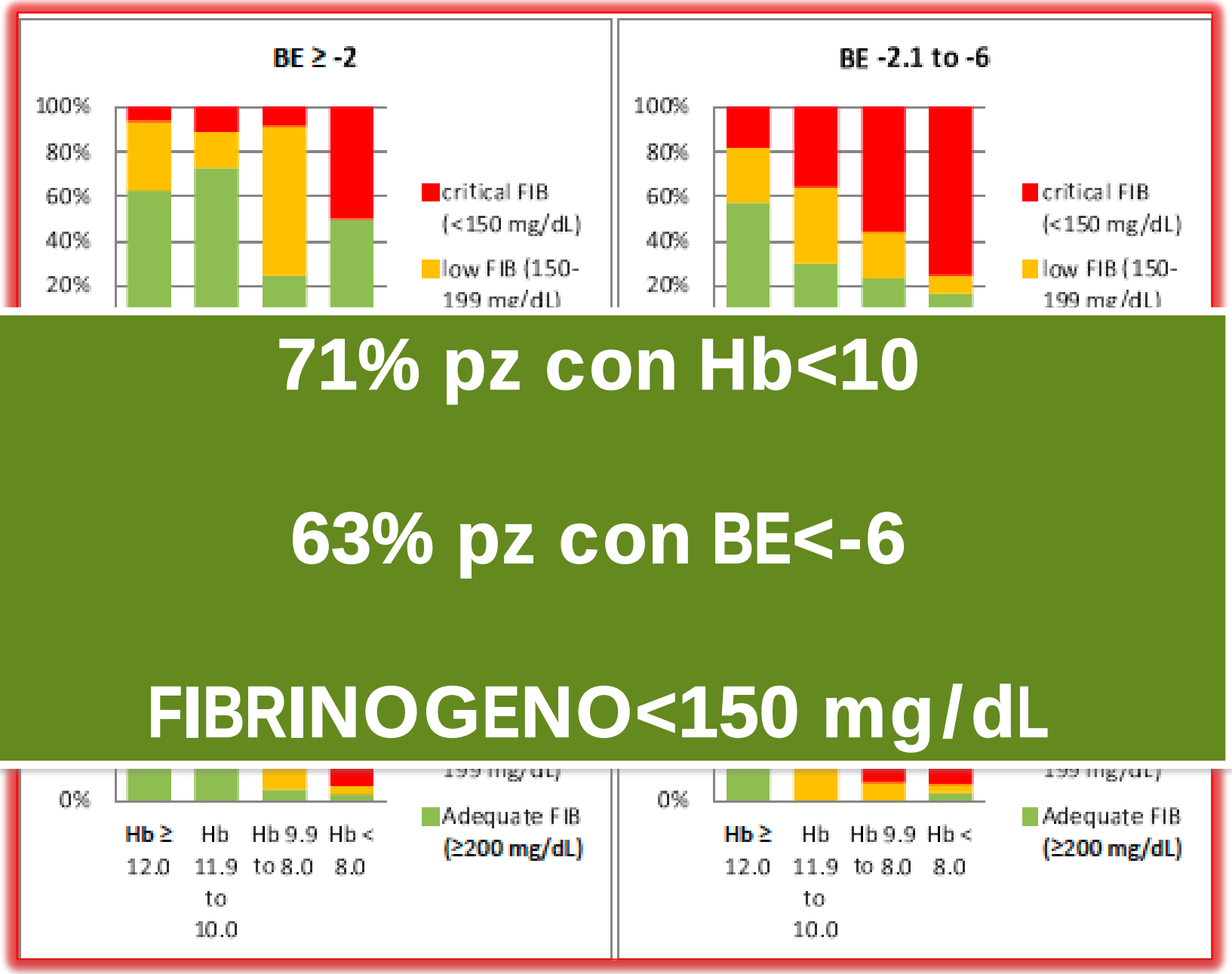
- **Fulminante < 30min**
  - ER: 11
  - ICU: 2
  - Sopravvissuti: 0
- **Intermedia 30 – 60 min**
  - ER: 5
  - ICU: 6
  - Sopravvissuti: 1
- **Tardiva > 60 min**
  - ER: 1
  - ICU: 7
  - Sopravvissuti: 4

Mortality 88%



FIBRINOGENO E COAGULOPATIA DA TRAUMA

Estimation of plasma fibrinogen levels based on hemoglobin, base excess and ISS upon emergency room admission



71% pz con Hb<10

63% pz con BE<-6

FIBRINOGENO<150 mg/dL

Rossaint et al. Critical Care (2016) 20:100
DOI 10.1186/s13054-016-1265-x

Critical Care

RESEARCH Open Access

The European guideline on management of major bleeding and coagulopathy following trauma: fourth edition

Rolf Rossaint[1], Bertil Bouillon[2], Vladimir Cerny[3,4,5,6], Timothy J. Coats[7], Jacques Duranteau[8], Enrique Fernández-Mondéjar[9], Daniela Filipescu[10], Beverley J. Hunt[11], Radko Komadina[12], Giuseppe Nardi[13], Edmund A. M. Neugebauer[14], Yves Ozier[15], Louis Riddez[16], Arthur Schultz[17], Jean-Louis Vincent[18] and Donat R. Spahn[19*]

TM

Tranex
Fibrinogeno

PFC
Fibrinogeno
PPC

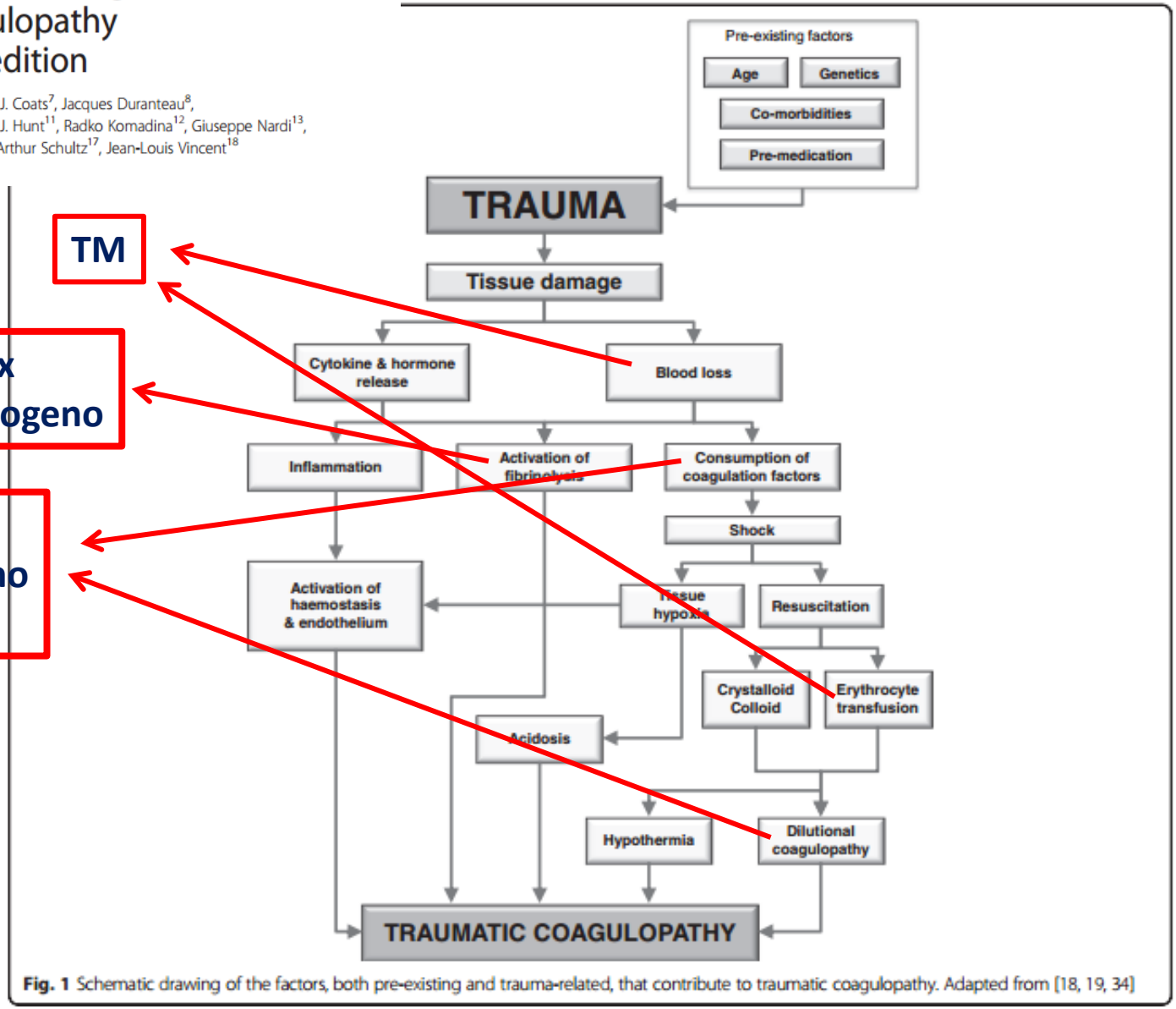


Fig. 1 Schematic drawing of the factors, both pre-existing and trauma-related, that contribute to traumatic coagulopathy. Adapted from [18, 19, 34]

Early Coagulation Support Protocol
In major trauma patients

We recommend that each institution implement an evidence-based treatment algorithm for the bleeding trauma patient. (Grade 1B)

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Trauma patient at risk for massive transfusion

Tranexamic acid 1 gr in bolous ev + 1 gr in 8 hous (Grade 1 A)

Emergency Room:
Venous o arterial blood gas analysis
Complete blood count
Standard coagulation tests (PT, aPTT, Fibrinogen)
Blood chemistries
Blood typing and cross matching

Blood sample (citrate) for TEG/Rotem

Alto sospetto di emorragia
+ (almeno 1)
SBP < 100 mmHg
Hb < 9 g/dl (su EGA)
Lac > 6 mOsm/L
Be < - 6 mmMol/L

NO

No bleeding risk

SI

Tranexamic acid 1 gr in bolous ev + 1 gr in 8 hous (Grade 1 A) se non già somministrato
Perform TEG/ROTEM (Grade 1 C)

The Team leader starts Early Massive Transfusion protocol:
- Call hematologist
- PBRC 4 U (without compatibility test)
- PBRC 4 U - FFP 4 U - PLT 10 U random
- Controlls based on standard test (30-40 min)

Fibrinogen 2 – 6 g according MA (Grade1 C); RBC according to Hb level (1 C)

If the patient received more than 3 U of PBRC e/o su TEG:
FFP or pathogen-inactivated plasma in a plasma-RBC ratio 1:2 (1 B)

PLT if PLT < 100.000 in TBI or if PLT < 50.000 in the other trauma.
Initial dose of 4-8 single platelet units or one aphaeresis pack (Grade 2C)

Repeat TEG/ROTEM o PFL (Plasma Fibrinogen Level) for additional fibrinogen

Hb between 7 and 9 g/dl
Mantain PT and APTT < 1.5 times the normal control (1 C)
Avoid plasma in pt without substantial bleeding (1 B)

Il paziente è in terapia con anticoagulanti? → **SI** → **REVERSE**

NO ↓

Tratta come da protocollo

Anticoagulanti K-dipendenti
1A

Sanguinamento massivo
in anticoagulanti non K antagonisti
NOAC Fat Xa e Trombina inibitore
2C

→ **PPC**
Alte dosi
TXA
Anticorpo

Mantenendo normali livelli di fibrinogeno (>150-200 mg/dl)
PPC o Plasma in pz che hanno evidenza di sanguinamento e/o presentano alterazioni alle valutazioni viscoelastiche
2C

Raccomandazione 33-34-35
2016

CME

Trauma Bleeding Management: The Concept of Goal-Directed Primary Care

Herbert Schöchl, MD,*† and Christoph J. Schlimp, MD†

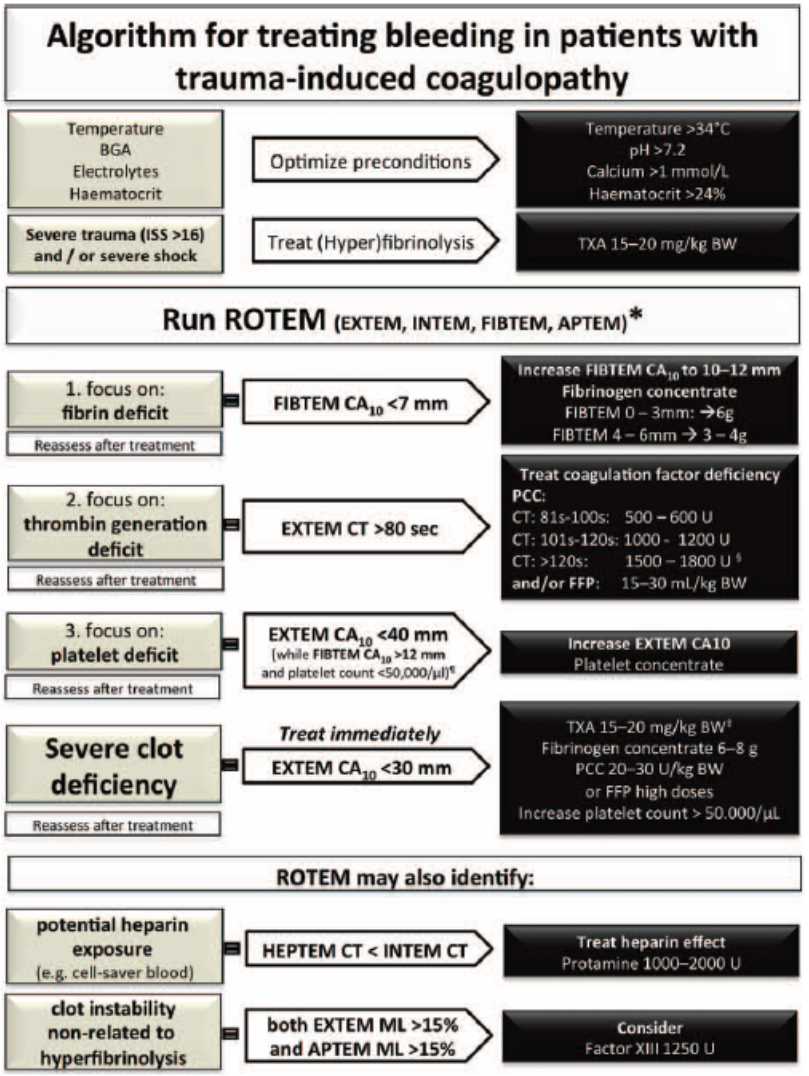
Anesth Analg 2014;119:1064–73

Goal-Directed, POC-Guided Hemostatic Therapy

Timing of Intervention

Ratio-Driven Volume Resuscitation

High Ratio of FFP:RBC

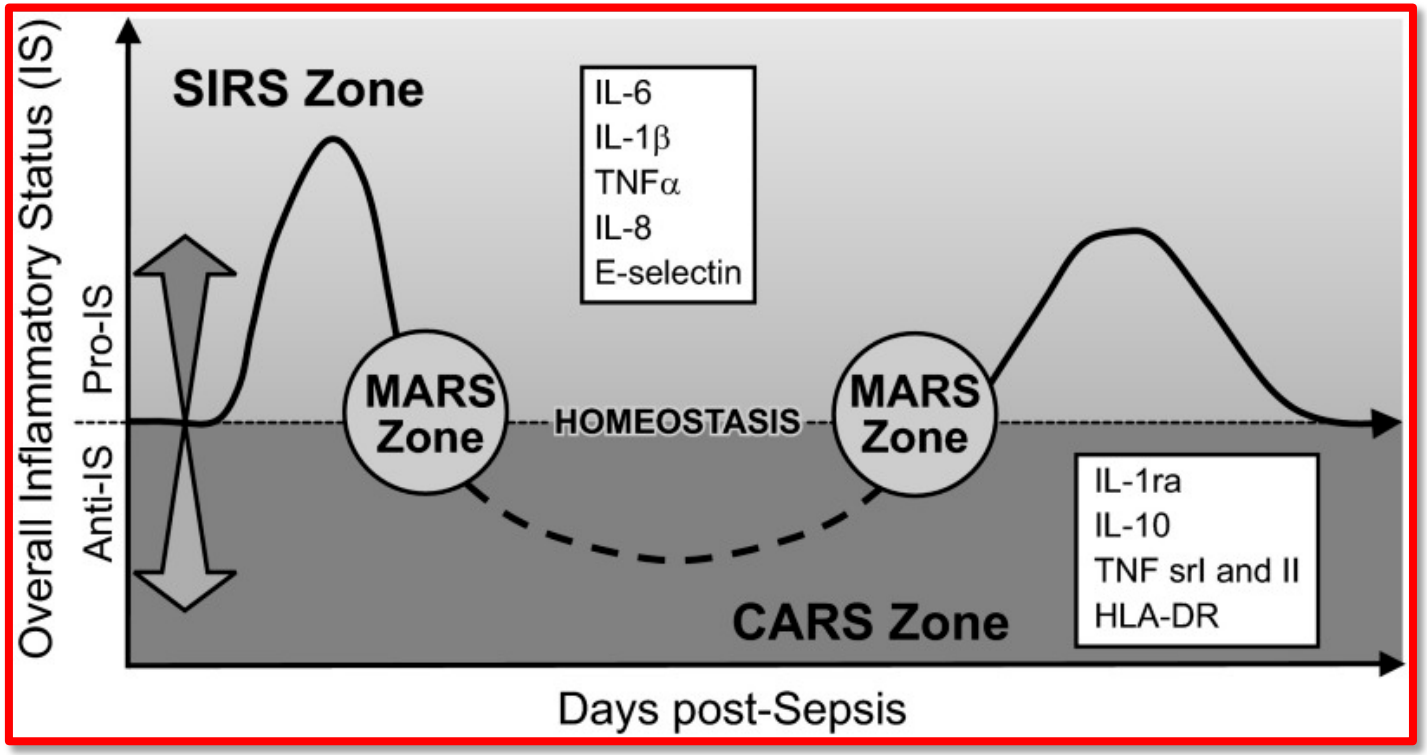


PATHOGENESIS OF MULTISYSTEM ORGAN DYSFUNCTION

Role

- DIC
- High mobility group box 1 - HMGB-1 - (Macrophages, endothelial cells, and monocytes are all capable of releasing HMGB-1 proteins)
- Neutrophil extracellular traps (NETS) are highly toxic to organs, induce inflammation, and promote thrombosis

THROMBOSIS AS A PROTECTIVE MECHANISM IN SEPSIS



DISSEMINATED INTRAVASCULAR COAGULATION

Highlights

- Disseminated intravascular coagulation (DIC) is a syndrome characterized by systemic intravascular activation of coagulation, leading to widespread deposition of fibrin in the circulation.

- Recent knowledge on important pathogenetic mechanisms that m… has resulted in novel preventive and therapeutic approaches t… this condition.

- Thrombin generation in DIC proceeds via the (e… factor/factor VIIa route and simultaneously occurring depress… mechanisms, such as antithrombin and the protein C system.

- Also, impaired fibrin degradat… high circulating levels of PAI-1, contributes to enhanced … fibrin deposition.

- The diagnosis o… made by sensitive laboratory tests, however, most of these tests … available in a routine setting.
- A relia… can also be made on the basis of a small series of routine lab tes… be combined in a scoring algorithm (ISTH-DIC score).

- … cornerstone of the management of DIC is the specific and vigorous treatment of the underlying disorder.

- Strategies aimed at the inhibition of coagulation activation or restoration of anticoagulant pathways have been found beneficial in experimental and initial clinical studies but their effect on clinically relevant outcomes is less clear.

Prevention of DIC is a key therapeutic target

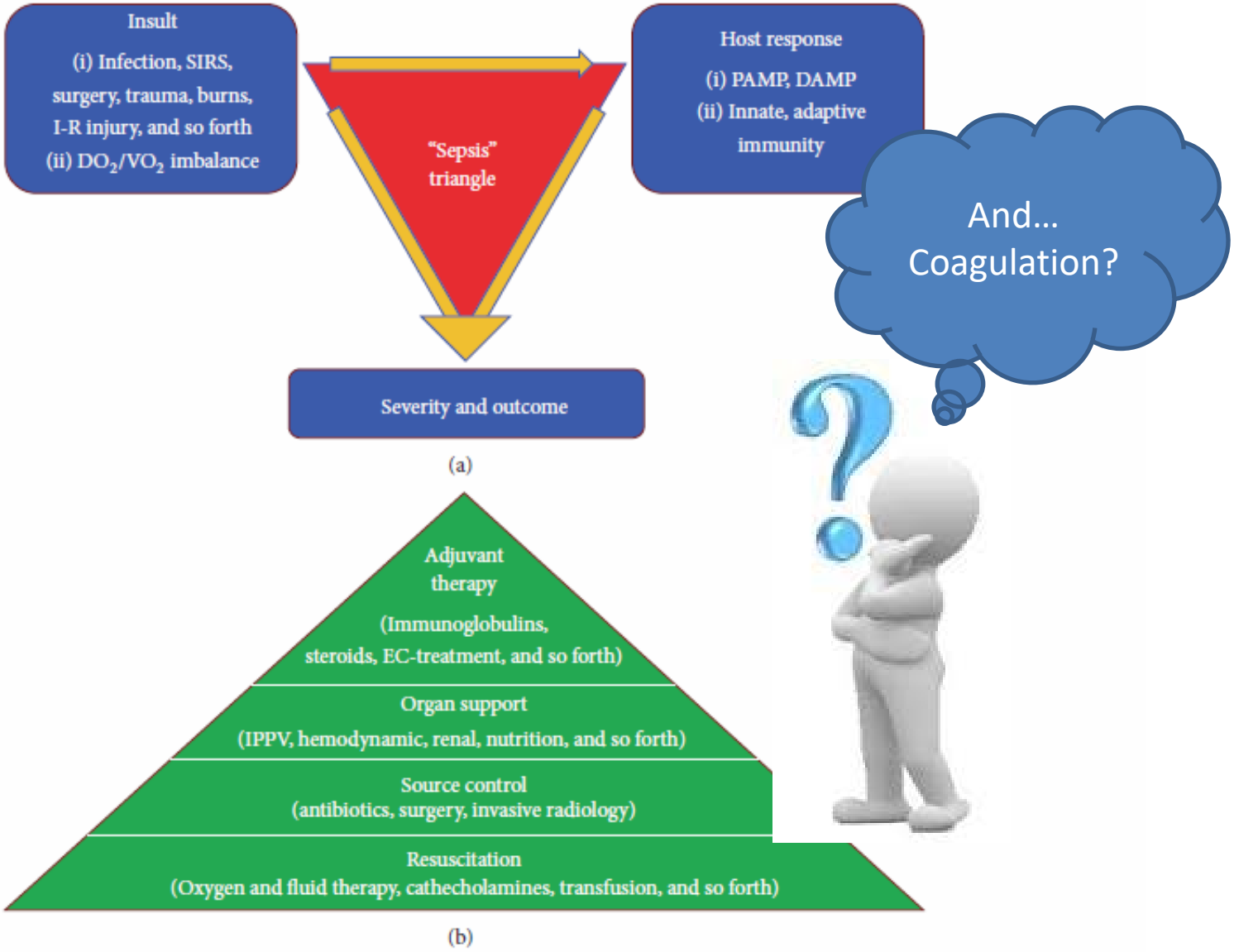


FIGURE 1: The "sepsis-triangles": pathomechanism and treatment. SIRS: systemic inflammatory response syndrome, I-R: ischemia-reperfusion, DO_2: oxygen delivery, VO_2: oxygen consumption, PAMP: pathogen-associated molecular patterns, DAMP: damage-associated molecular patterns, EC: extra corporeal, and IPPV: intermittent positive pressure ventilation.

«Early»-goal directed therapy

Blood Product Administration

RBC transfusion occur only when hemoglobin concentration decreases to **< 7.0 g/ dL** in adults in the absence of extenuating circumstances, such as myocardial ischemia, severe hypoxemia, or acute hemorrhage

(strong recommendation, high quality of evidence).

Blood Product Administration

Prophylactic platelet transfusion

when counts are **<10,000/mm^3** in the absence of apparent bleeding and

when counts are **<20,000/mm^3** if the patient has a significant risk of bleeding.

Higher platelet counts **(≥50,000/mm^3)** are advised for active bleeding, surgery, or invasive procedures

(weak recommendation, very low quality of evidence).

GUIDELINES are against the use of fresh frozen plasma to correct clotting abnormalities in the absence of bleeding or planned invasive procedures

(weak recommendation, very low quality of evidence).

Blood Product Administration

GUIDELINES are Against the use of erythropoietin for treatment of anemia associated with sepsis . Why??**

(strong recommendation, moderate quality of evidence).

***Erythropoietin administration may be associated with an increased incidence of thrombotic events in the critically ill.*

Key Points

Inflammation and disturbances in coagulation are inseparably tied, with each acting as positive feedback for activation of the other

Coagulation abnormalities are nearly universal in septic patients and likely play a key role in multisystem organ dysfunction

Coagulopathy in sepsis is likely driven by derangements of multiple pathways versus a single mediator, which explains why many singe therapies have failed to improve outcomes

Therapies directed toward the Coagulopathy of Acute Sepsis should ideally restore the balance of inflammation and coagulation without negatively influencing the host's response to infection

Therapeutic strategies are time sensitive and should target patients at high risk for developing DIC

So.....

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INTENSIVE CARE & PHYSIOLOGY

Viscoelastic and aggregometric point-of-care testing in patients with septic shock – cross-links between inflammation and haemostasis

T. BRENNER ✉, K. SCHMIDT, M. DELANG, A. MEHRABI, T. BRUCKNER, C. LICHTENSTERN, E. MARTIN, M. A. WEIGAND, S. HOFER

Thromboelastography Technology

TEG

ROTEM Delta

Viscoelastic and aggregometric point-of-care testing

- was shown to be potentially useful for bedside diagnosis of sepsis
- was able to determine the phase of septic coagulopathy (hypercoagulability vs. hypocoagulability)
- was able to identify patients at high risk for overt disseminated intravascular coagulation

Whole Blood Viscoelastic Testing

Theoretically, viscoelastic measurements of whole blood should provide clinicians with insight into in-vivo coagulation

Intensive Care Med (2015) 41:77–85
DOI 10.1007/s00134-014-3552-9

ORIGINAL

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Thromboelastography in patients with severe sepsis: a prospective cohort study

Patients with sepsis presented with varying viscoelastic results including hypo-, normo- and hypercoagulability, which may be due to varying severity of disease and timing of sampling

Only functional fibrinogen MA increased during the observation period, while the median value of the other TEG variables remained relatively constant

Hypocoagulable viscoelastic profiles have previously been associated with increased severity of disease more progressive coagulation disturbances such as disseminated intravascular coagulation and increased risk of death

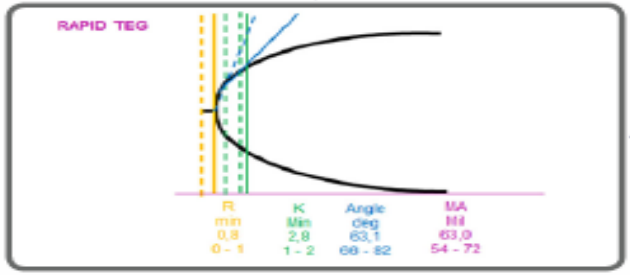
Other studies

Hypocoagulable 22%
Normal 48%
Hypercoagulable 30%

Patients that were hypocoagulable more often progressed to MODS and death

Terapia trasfusionale guidata da ROTEM/TEG [Brizzi, 2014] *

- Somministrare PLT
- Monitorare la coagulazione: ripetere INR, PPT, fibrinogeno, PLT e TEG ogni 60-90 min
- Eventuale richiesta di ulteriori emoderivati



R

- R > 1
- 0 < R < 1

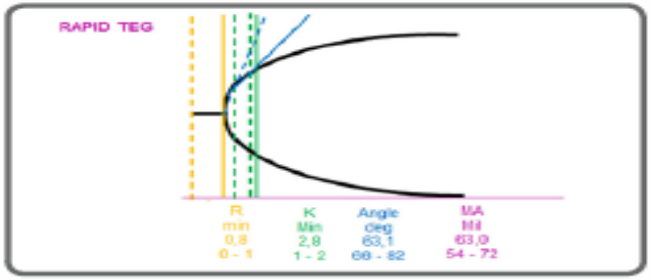
MA

- 54 < MA < 72

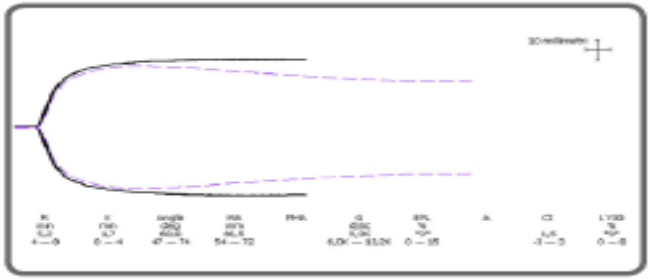
MA < 54

- FIBRINOGENO FUNZIONALE
- MA
  - 9 < MA < 29
  - MA < 9

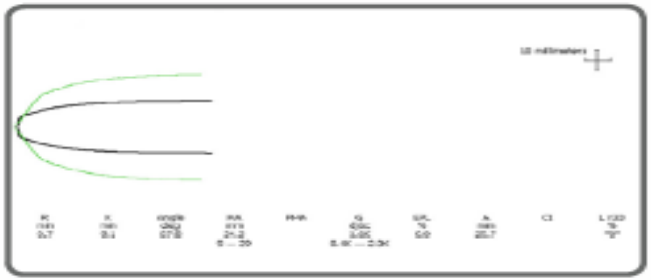
* Valori suggeriti sulla base dei protocolli operativi in uso dagli estensori del documento, in mancanza di parametri validati e standardizzati in letteratura



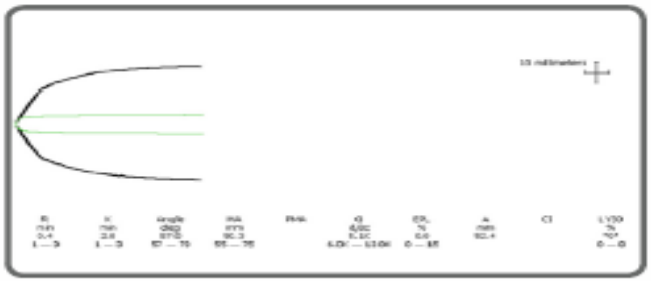
CARENZA DI FATTORE DELLA COAGULAZIONE → PLASMA/ CRIOPRECIPITATI



SANGUINAMENTO CHIRURGICO → CHIRURGO ESPERTO



CARENZA DI PIASTRINE → PIASTRINE



CARENZA DI FIBRINOGENO → FIBRINOGENO

Risultati analisi TEG®

Generati: 28/01/2016 07:06:01

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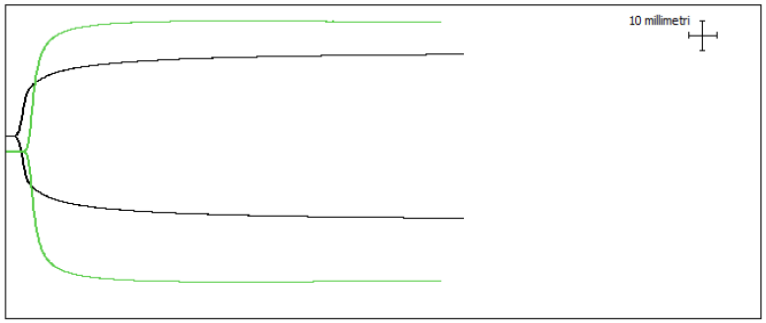
Hypercoagulable

MAp = 34,9 ANGp = 10,6 FLEV = 896,0 mg/dl



Tracciati dall'alto verso il basso:

Seq	Canale	Paziente	ST	Descrizione campione			Operatore	Analizza
1	2	Caruso, Massimiliano -- 10686640	FF	sospetta trombosi centrale	27/01/2016	10:12	Temporary Operator	01
2	1	Caruso, Massimiliano -- 10686640	CK	sospetta trombosi centrale	27/01/2016	10:10	Temporary Operator	01

Seq	Channel	R min	K min	Angle deg	MA mm	PMA	G Kd/sc	EPL %	A mm	CI	LY30 %
1	2	2,2	1,0	73,4	49,1		4,8	0,0	53,7		0,0
2	1	3,8	0,8	80,8	84,0	0,0	26,2	0,0	84,8	5,9	0,0
Mean		3,0	0,9	77,1	66,6	0,0	15,5	0,0	69,2	5,9	0,0
n		2	2	2	2	1	2	2	2	1	2
SD		1,1	0,1	5,2	24,7	0,0	15,1	0,0	22,0	0,0	0,0
Min		2,2	0,8	73,4	49,1	0,0	4,8	0,0	53,7	5,9	0,0
Max		3,8	1,0	80,8	84,0	0,0	26,2	0,0	84,8	5,9	0,0

Risultati analisi TEG®

Generati: 25/01/2016 19:11:47

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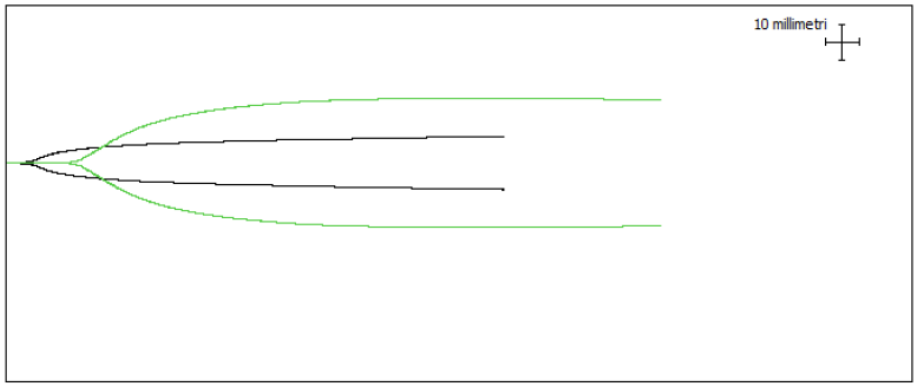
Hypocoagulable

MAp = 23,1 ANGp = 16,9 FLEV = 166,1 mg/dl



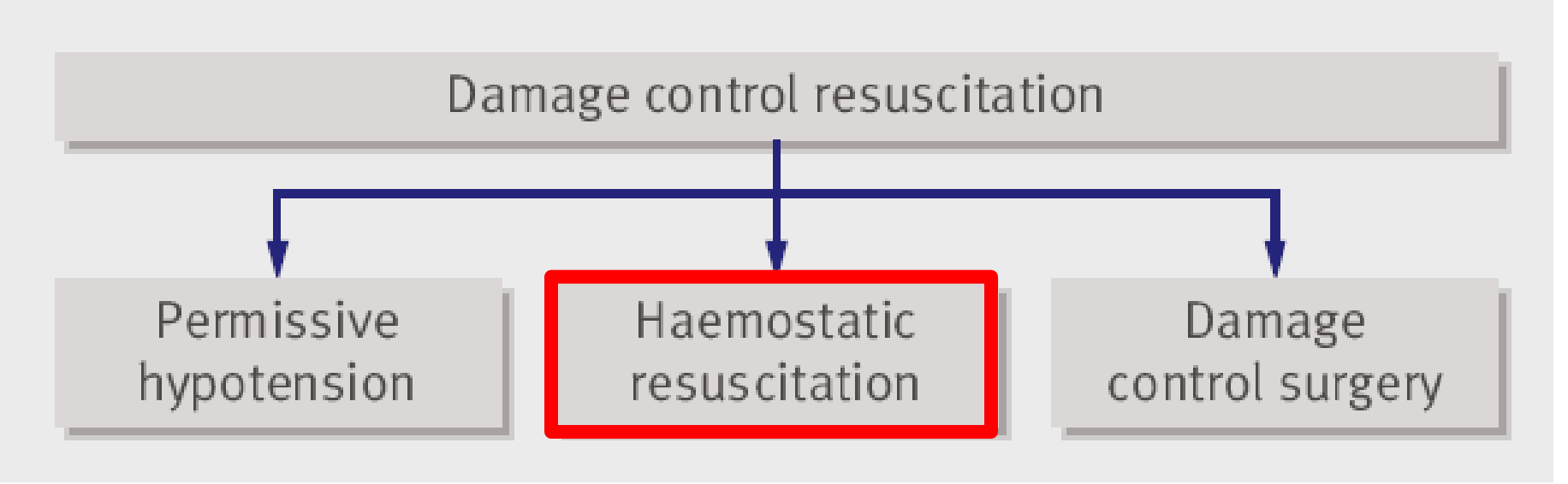
Tracciati dall'alto verso il basso:

Seq	Canale	Paziente	ST	Descrizione campione			Operatore	Analizza
1	2	chimenti, sergio -- 30924831	FF	basale	25/01/2016	04:44	Temporary Operator	01
2	1	chimenti, sergio -- 30924831	CK	basale	25/01/2016	04:43	Temporary Operator	01

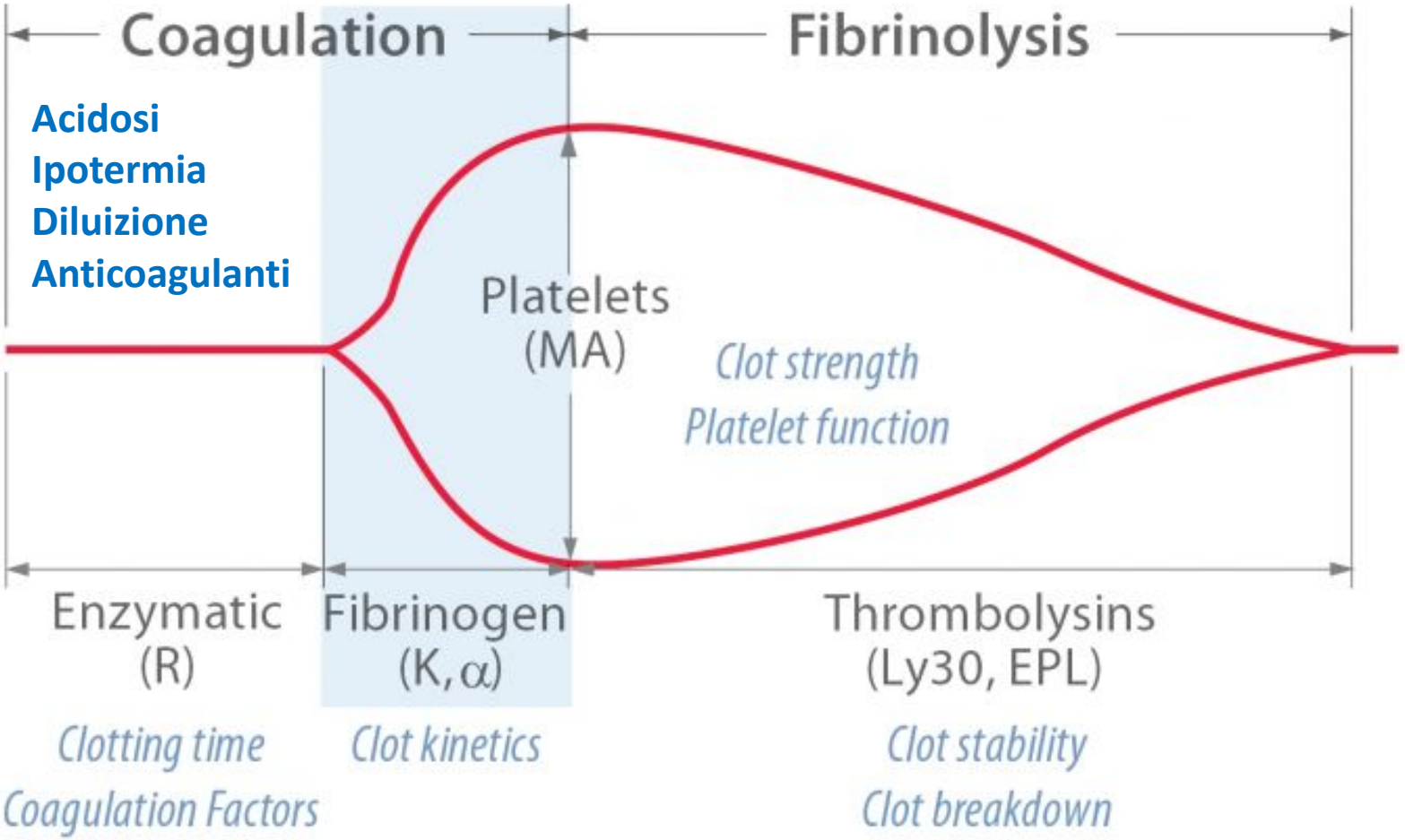
Seq	Channel	R min	K min	Angle deg	MA mm	PMA	G Kd/sc	EPL %	A mm	CI	LY30 %
1	2	4,6	N/A	15,3	9,1		0,5	0,0	14,6		0,0
2	1	11,2	9,2	25,6	32,2	1,0	2,4	0,0	34,6	-12,7	0,0
Mean		7,9	9,2	20,5	20,7	1,0	1,4	0,0	24,6	-12,7	0,0
n		2	1	2	2	1	2	2	2	1	2
SD		4,7	0,0	7,3	16,3	0,0	1,3	0,0	14,1	0,0	0,0
Min		4,6	9,2	15,3	9,1	1,0	0,5	0,0	14,6	-12,7	0,0
Max		11,2	9,2	25,6	32,2	1,0	2,4	0,0	34,6	-12,7	0,0

Damage control resuscitation for patients with major trauma

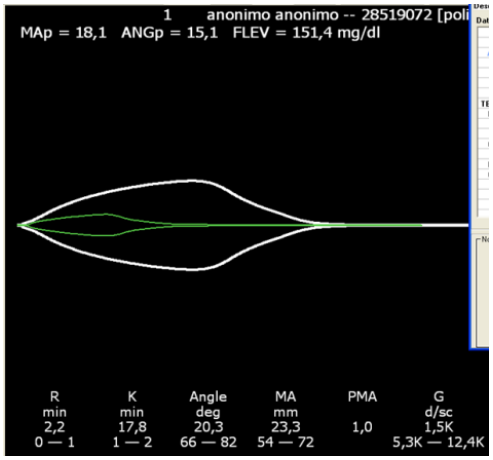
BMJ | 13 JUNE 2009 | VOLUME 338

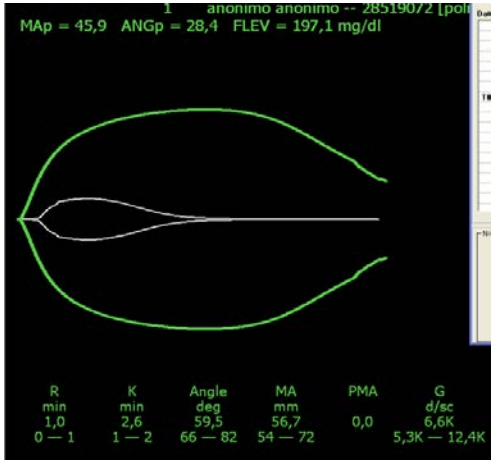


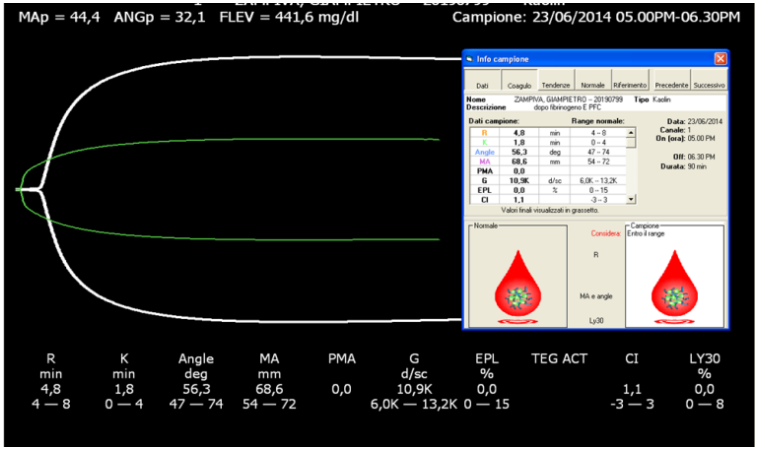
Thromboelastography



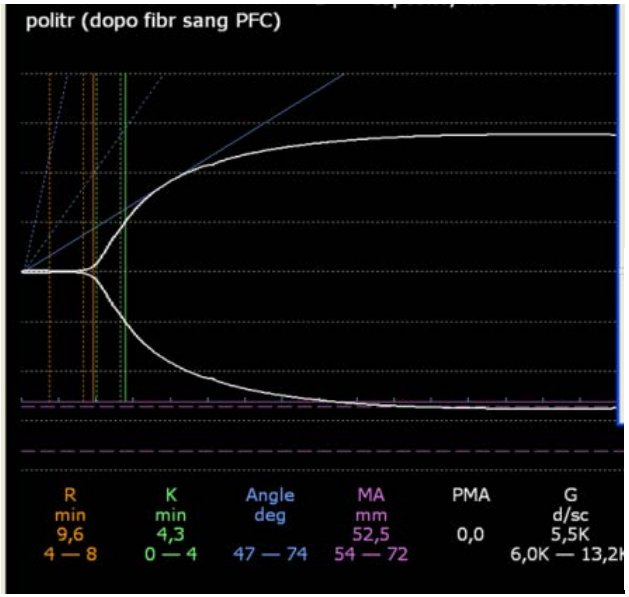
The TEG System provides visual representation of your patient's hemostasis







34% of trauma-related admissions



Johansson *et al. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine* 2012, **20**:47
http://www.sjtrem.com/content/20/1/47

SCANDINAVIAN JOURNAL OF
trauma, resuscitation & emergency medicine

REVIEW Open Access

Current management of massive hemorrhage in trauma

Pär I Johansson[1,3*], Jakob Stensballe[1,2] and Sisse R Ostrowski[1]

PLOS ONE

RESEARCH ARTICLE

Thromboelastometry profile in critically ill patients: A single-center, retrospective, observational study

Tomaz Crochemore[1☯*], Thiago Domingos Corrêa[1☯], Marcus D. Lance[2], Cristina Solomon[3,4], Ary Serpa Neto[1], João Carlos de Campos Guerra[5], Priscila Scolmeister Lellis[5], Livia Muller Bernz[1], Natalia Nunes[1], Cassio Massashi Mancio[1], Ana Paula Hitomi Yokoyama[6], Eliézer Silva[1]

Table 3. Conventional coagulation tests according to rotational thromboelastometry profile.

Characteristcs	Normal	Hypocoagulability	Hypercoagulability	P value*
INTEM	193/352 (54.8)	126/352 (35.8)	33/352 (9.4)	
Platelets <150 x10^3/mm^3	100/193 (51.8)	120/126 (95.2)	2/33 (6.1)	<0.001
INR >1.5	46/193 (23.8)	92/126 (73.0)	6/33 (18.2)	<0.001
aPTT >32 s	135/193 (69.9)	110/126 (87.3)	28/33 (84.8)	0.001
Fibrinogen <150 mg/dl	4/193 (2.1)	60/126 (47.6)	0/33 (0.0)	<0.001
EXTEM	179/331 (54.1)	133/331 (40.2)	19/331 (5.7)	
Platelets <150 x10^3/mm^3	100/179 (55.9)	128/133 (96.2)	3/19 (15.8)	<0.001
INR >1.5	49/179 (27.4)	100/133 (75.2)	6/19 (31.6)	<0.001
aPTT >32 s	114/179 (63.7)	120/133 (90.2)	15/19 (78.9)	<0.001
Fibrinogen <150 g/dl	7/179 (3.9)	65/133 (48.9)	0/19 (0.0)	<0.001
FIBTEM	278/522 (53.3)	136/522 (26.1)	108/522 (20.7)	
Platelets <150 x10^3/mm^3	155/278 (55.8)	123/136 (90.4)	53/108 (49.1)	<0.001
INR >1.5	80/278 (28.8)	104/136 (76.5)	30/108 (27.8)	<0.001
aPTT >32 s	184/278 (66.2)	117/136 (86.0)	90/108 (83.3)	<0.001
Fibrinogen <150 mg/dl	8/278 (2.9)	83/136 (61.0)	1/108 (0.9)	<0.001

Values represent No./total No. (%). INR: international normalized ratio and aPTT: activated partial thromboplastin time.

* p values were calculated with the use of Chi-square test or fisher exact test.

I pz con ROTEM normale
25% ca avevano PLT<150.000) e aPTT >32 s
25% ca presentavano INR >1.5

Il profilo ipocoagulabile presentava più alterazioni del CCT in corrispondenza del profilo di ipocoagulabilità con Trombocitopenia, prolungamento dell'aPTT ed aumento dell'INR.

Il 50% dei pz con profilo di ipocoagulabilità presentavano IPOFIBRINOGENEMIA (fibrinogeno <150 mg/dL).

Il profilo di ipercoagulabilità frequentemente esibiva un aPTT allungato ed un aumento dell'INR.

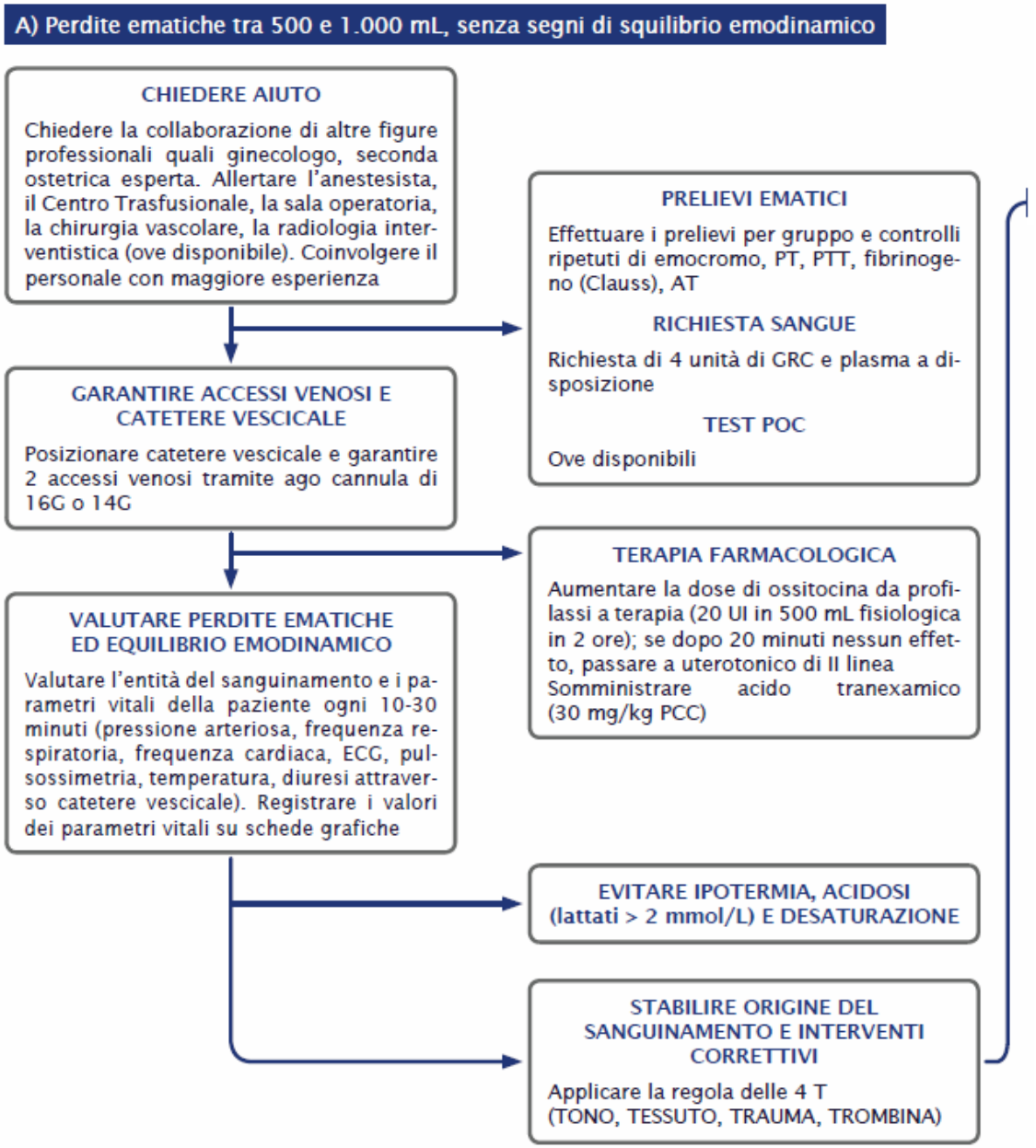
Il 50% ca dei pz ipercoagulabili presentava una conta piastrinica<1500000.

50% ca dei pz profilo CCT e ROTEM normale
25% ca profilo Ipocoagulabilità
25% ca profilo Ipercoagulabilità

Most of the critically ill patients admitted to ICU exhibited a normal coagulation profile according to ROTEM, although CCT suggested presence of coagulopathy.
Transfusion therapy based on CCT led to a large number of patients receiving allogeneic blood transfusion, possibly unnecessarily. The use of ROTEM to identify the underlying coagulopathy and as a transfusion guide in this population of critically ill patients has the potential to avoid inappropriate allogeneic blood product transfusions

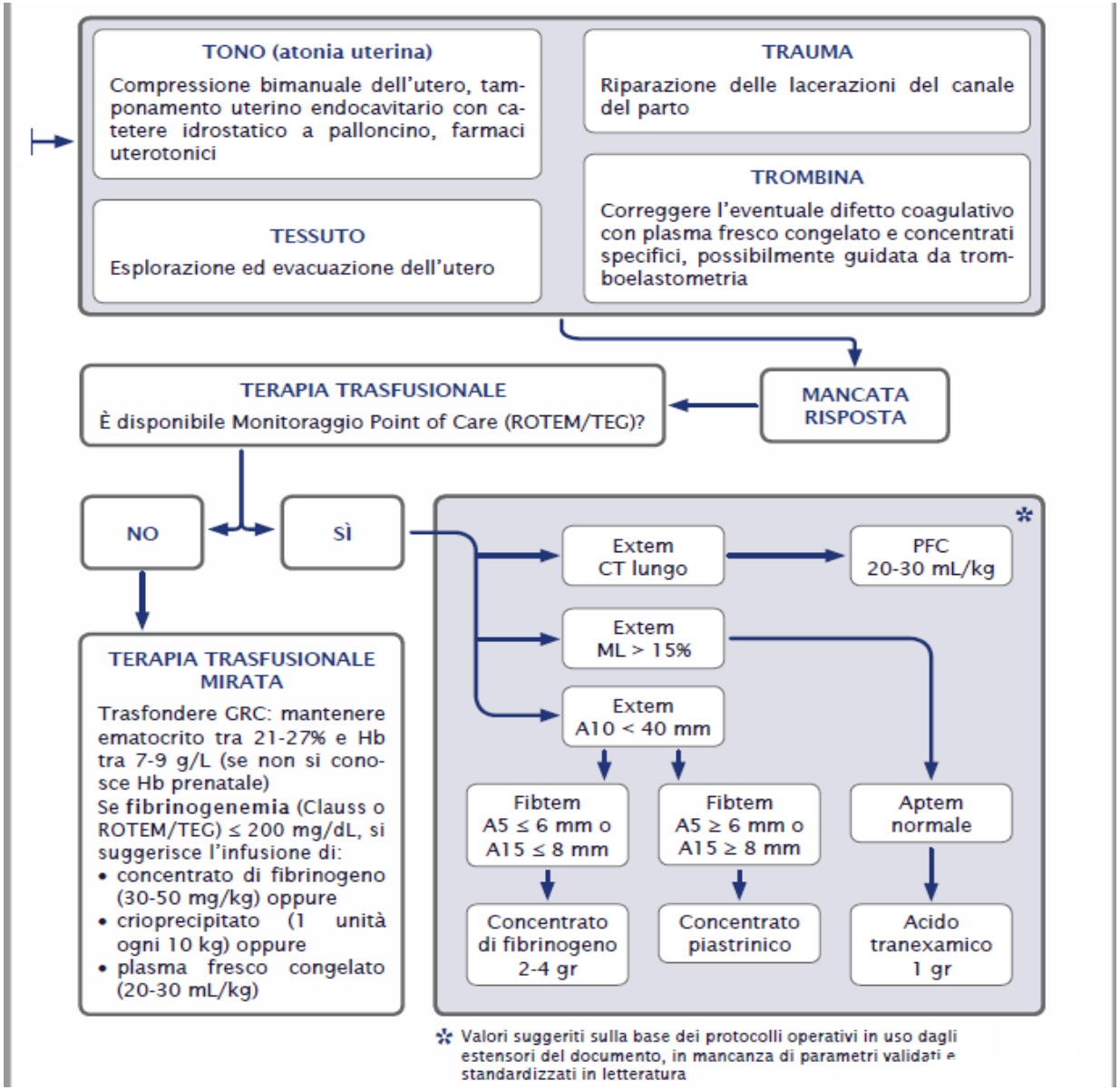
GESTIONE MULTIDISCIPLINARE DELL'EMORRAGIA POST-PARTUM

Algoritmo

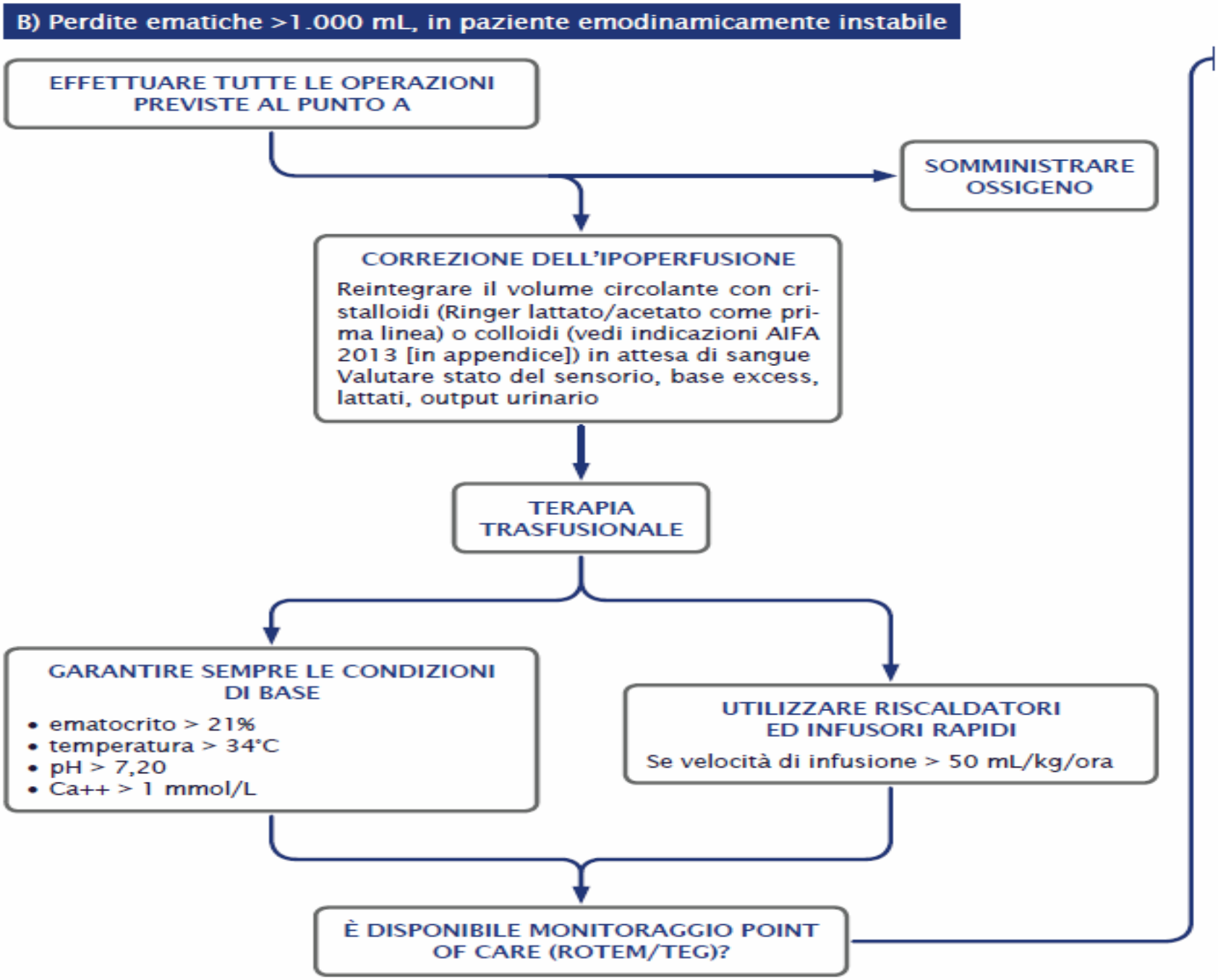


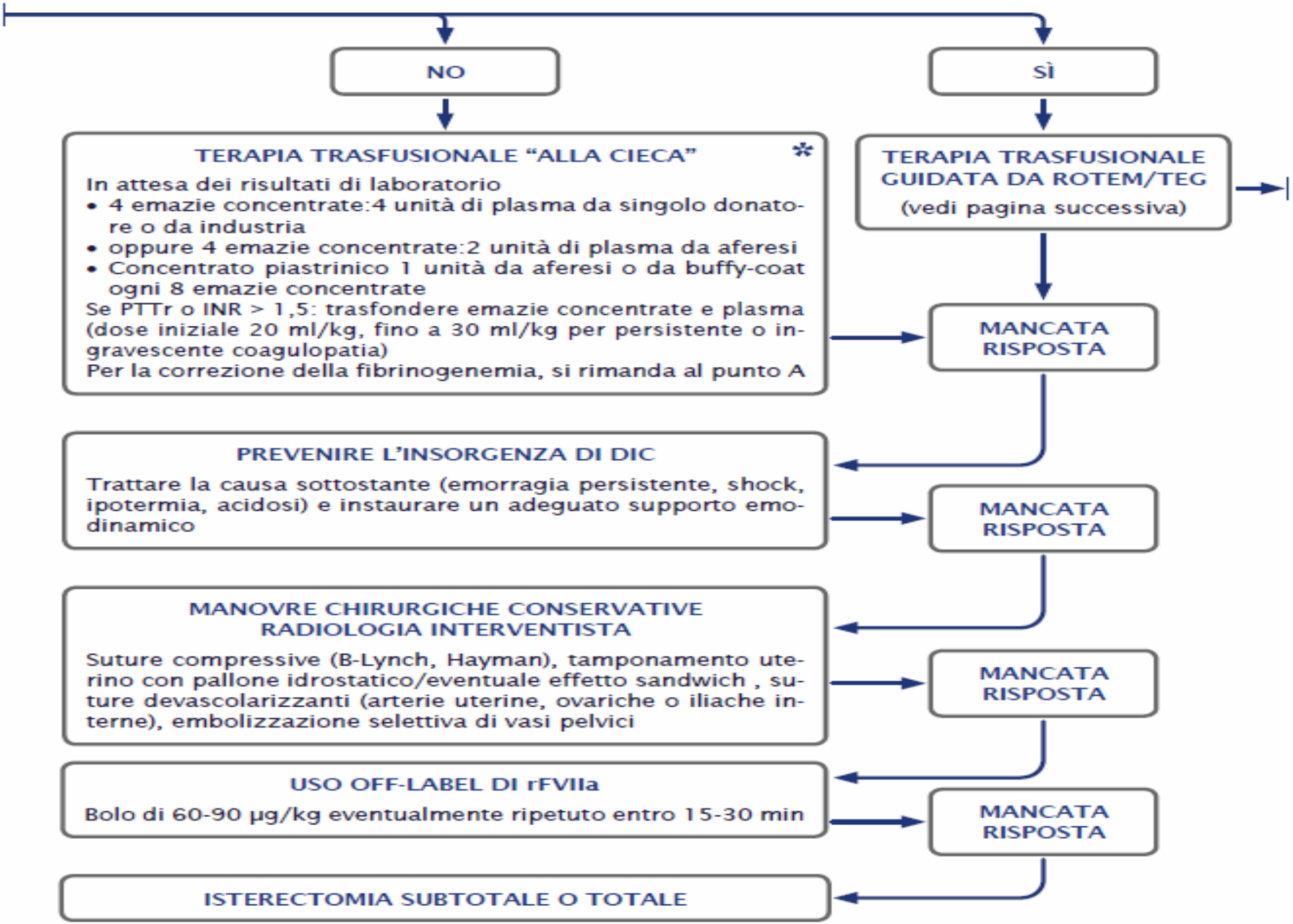
GESTIONE MULTIDISCIPLINARE DELL'EMORRAGIA POST-PARTUM

Algoritmo



* Valori suggeriti sulla base dei protocolli operativi in uso dagli estensori del documento, in mancanza di parametri validati e standardizzati in letteratura


B) Perdite ematiche >1.000 mL, in paziente emodinamicamente instabile
EFFETTUARE TUTTE LE OPERAZIONI PREVISTE AL PUNTO A
SOMMINISTRARE OSSIGENO
CORREZIONE DELL'IPOPERFUSIONE
Reintegrare il volume circolante con cristalloidi (Ringer lattato/acetato come prima linea) o colloidi (vedi indicazioni AIFA 2013 [in appendice]) in attesa di sangue
Valutare stato del sensorio, base excess, lattati, output urinario
TERAPIA TRASFUSIONALE
GARANTIRE SEMPRE LE CONDIZIONI DI BASE
• ematocrito > 21%
• temperatura > 34°C
• pH > 7,20
• Ca++ > 1 mmol/L
UTILIZZARE RISCALDATORI ED INFUSORI RAPIDI
Se velocità di infusione > 50 mL/kg/ora
È DISPONIBILE MONITORAGGIO POINT OF CARE (ROTEM/TEG)?



* Valori suggeriti, da applicare in base a situazione clinica e disponibilità emocomponenti

SYNAPSES

Come neuroni siamo tutti interconnessi e parte di una rete culturale sinaptica. Alcuni di noi sono passivi e periferici, altri sono stelle sociali attive, ma tutti svolgiamo un ruolo nella costruzione e trasformiamo l'ambiente sociale in cui viviamo.