



Early Coagulation Support - ECS



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Prevention and treatment of trauma induced coagulopathy (TIC). An intended protocol from the Italian trauma update research group

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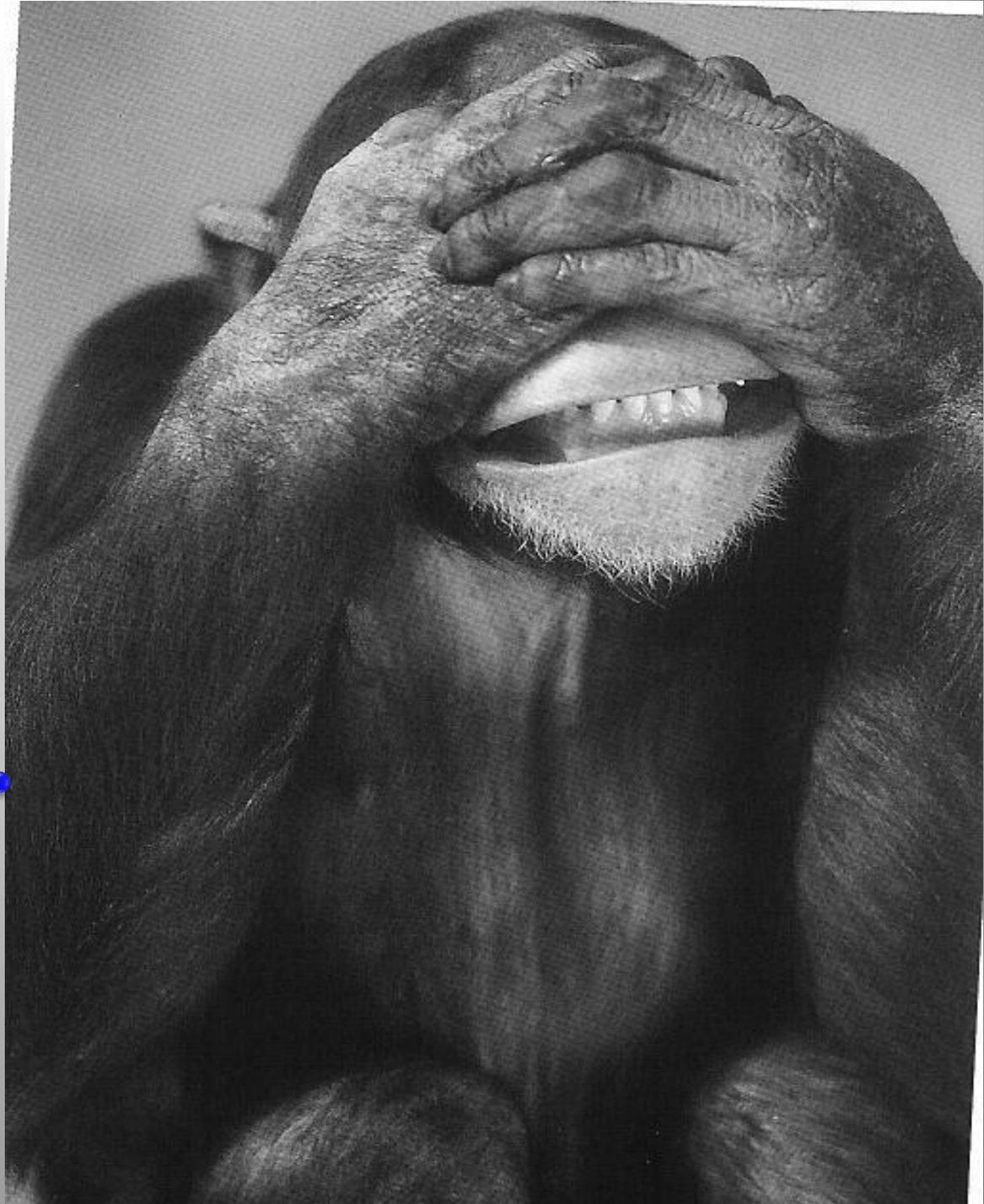
**Early Coagulation
Support protocol**



A Protocol



For
Dummies...



Prevention and treatment of trauma induced coagulopathy (TIC). An intended protocol from the Italian trauma update research group

Abstract

In recent years, a strong focus has been put on the need to assure early coagulation support in order to prevent and treat coagulopathy in patients with severe trauma, and to improve survival. Aggressive plasma administration with high plasma/red blood cells ratio is increasingly used worldwide. However, plasma transfusion is associated with increased risks of multiple organ dysfunction syndrome (MODS), adult respiratory distress syndrome (ARDS) and infection, which may prolong hospital stay and the need for artificial ventilation. Moreover, in the majority of European hospitals plasma cannot be immediately available and therefore it has been reported a significant delay in coagulation support. This has led to the proposal of using clotting factors as an alternative to plasma. However, strong evidence to define the best strategy is still missing, and the only published protocols are Institution-specific, thus depending on the local organization and the available resources. The Italian Trauma Centers Network (TUN) recently developed a treatment protocol aiming at shortening the interval before the onset of coagulation support and at reducing the use of plasma. We present this protocol -Early Coagulation Support (ECS) Protocol - and discuss its rationale. Its implications for the trauma-team workflow and hospital organization are also addressed. The ECS protocol must be considered as an integrated part of a comprehensive Damage Control Strategy. The impact of the ECS Protocol on blood products consumption, trauma mortality and morbidity as well as its financial aspects, will be strictly monitored by the TUN hospitals.

The ECS protocol **must be considered as an integral part of the Damage Control Resuscitation Strategy**

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ECS strategy:

- **Avoid Colloids**
- **Reduce Crystalloids (early phase)**
- **Ensure earlier Coagulation Support**

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1st Goal : ensure earlier Coagulation Support

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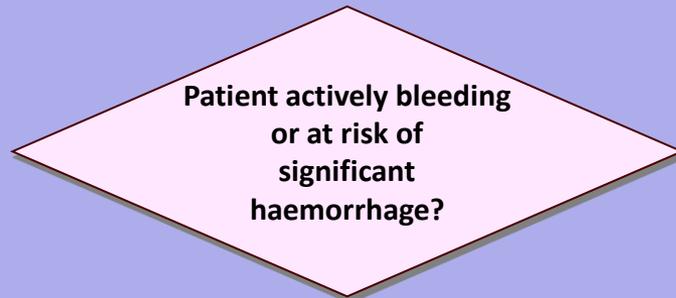
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2nd Goal :reduce the unnecessary administration of Plasma

Step 1



ECS



**Patient actively bleeding
or at risk of
significant
haemorrhage?**

**Actively bleeding
or at risk?**

YES

Collect blood samples for: haemoglobin, PTL, glucose and electrolytes, fibrinogen, standard coagulation (PTT, INR), blood gas analysis + lactate cross match + thromboelastometry/graphy

**Collect blood
before treatment**

Tranexamic acid (1 g + 1 g over 8 hours)

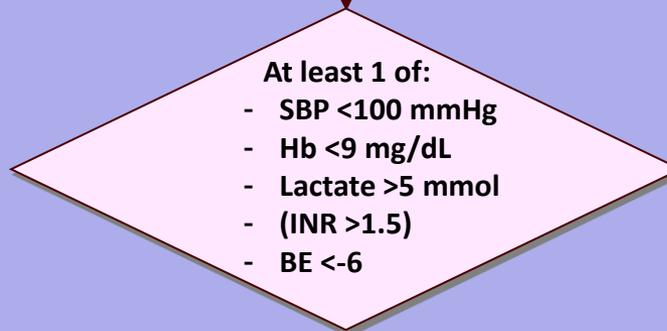
**Tranexamic Acid
Level 1**

Step 3



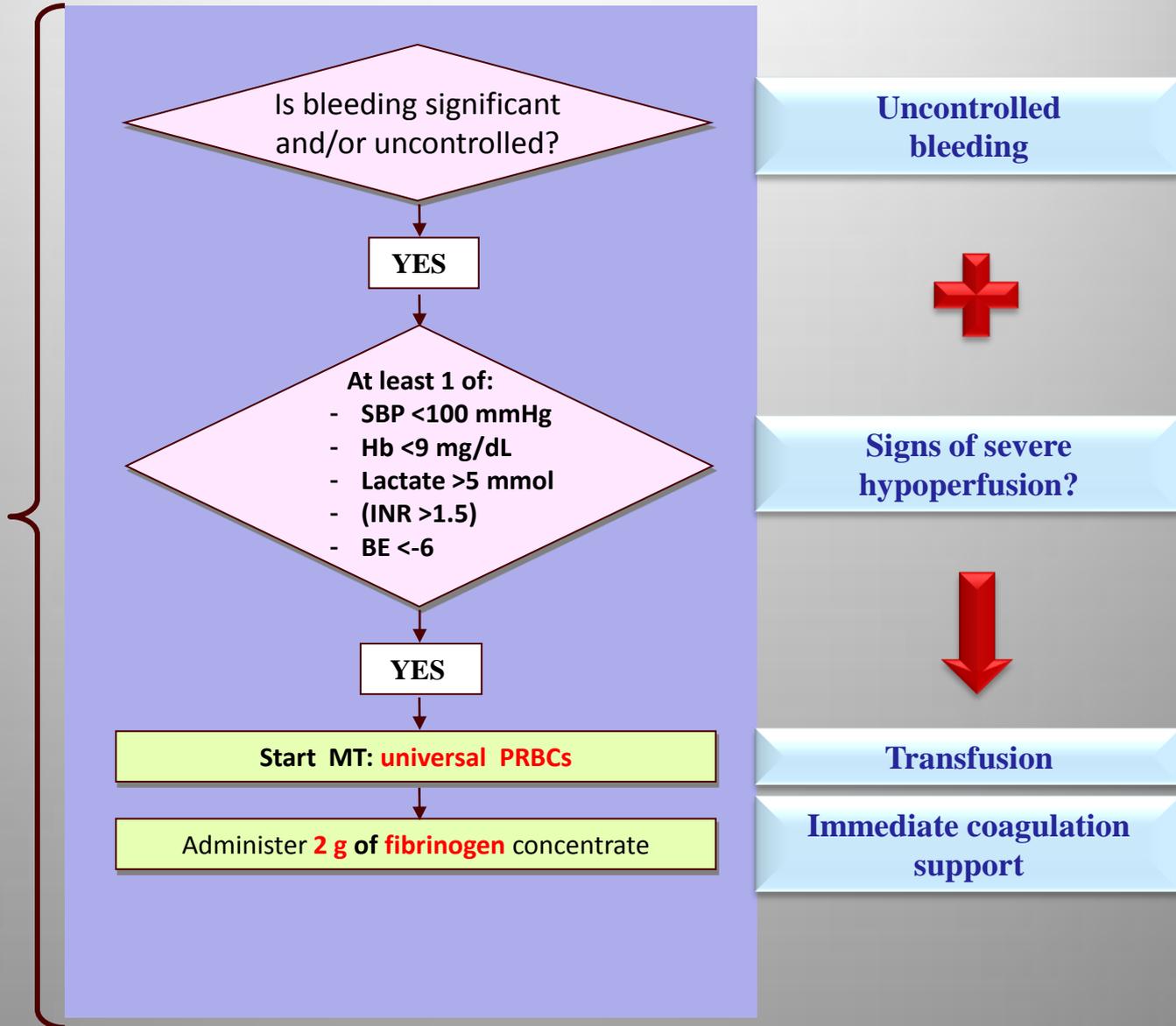
Uncontrolled bleeding

YES

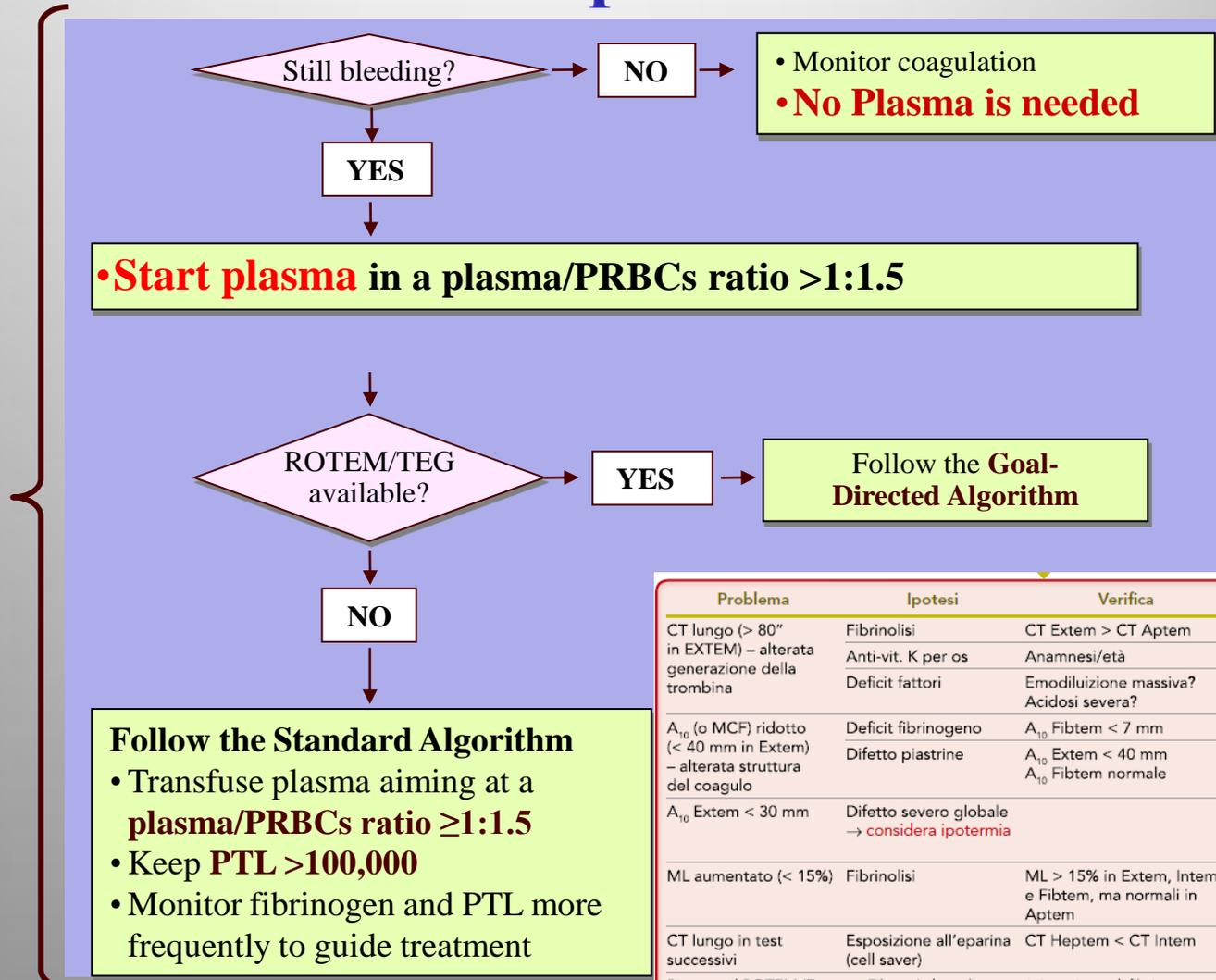


Signs of severe hypoperfusion?

Step 3



Volume support & continue coagulation support Step 4



Problema	Ipotesi	Verifica	Terapia
CT lungo (> 80" in EXTEM) – alterata generazione della trombina	Fibrinolisi	CT Extem > CT Aptem	Acido tranexamico
	Anti-vit. K per os	Anamnesi/età	PCC 25 U/kg
	Deficit fattori	Emodiluzione massiva? Acidosi severa?	Plasma (+ fibrinogeno se $A_{10} < 7$ mm)
A_{10} (o MCF) ridotto (< 40 mm in Extem) – alterata struttura del coagulo	Deficit fibrinogeno	A_{10} Fibtem < 7 mm	Fibrinogeno 2-4 g
	Difetto piastrine	A_{10} Extem < 40 mm A_{10} Fibtem normale	PLT da aferesi (a 100.000)
A_{10} Extem < 30 mm	Difetto severo globale → considera ipotermia		Acido tranexamico + fibrinogeno 2-4 g + plasma + PLT da aferesi
ML aumentato (< 15%)	Fibrinolisi	ML > 15% in Extem, Intem e Fibtem, ma normali in Aptem	Acido tranexamico
CT lungo in test successivi	Esposizione all'eparina (cell saver)	CT Heptem < CT Intem	Protamina 1.000-2.000 U

Ripetere il ROTEM (Extem e Fibtem) dopo la somministrazione di fibrinogeno (entro 60') e successivamente dopo ogni 4 unità di emazie (o ogni 2 ore se il sanguinamento non si arresta). In caso di reinfusione da cell-saver o eparinizzazione eseguire anche Heptem e Intem.

IS IT
EFFECTIVE ?

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Blood Products Consumption

Trauma Mortality

Costs



Methods

Retrospective/Prospective multicenter
pre/post cohort Study.

ECS



2011

2013



1:1 Strategy



ECS



Methods

Admission Criteria

- **Major Trauma victims (ISS > 15)**
- **≥ 3 PRBC within 24 hrs**



Methods

Exclusion Criteria

- Referred > 6hrs after the accident
- Admitted in Cardiac arrest
- Pre-Hospital Cardiac arrest



Results

	2011	2013
Major Trauma pts. (ISS>15)	435	431
ISS > 15 and ≥ 3 PRBCs	130	96

	2011	2013	
ISS > 15	435	431	
ISS > 15 and ≥ 3 PRBCs	130	96	
AGE	48,8	51,1	Ns
Gender (f/m)	27%	32%	Ns
Direct/referral	68%	70%	Ns
GCS	10,8	10.8	Ns
SBP	108,4	104,8	Ns
ISS	32,92	33,58	Ns
AIS head	2,19	2,49	Ns
AIS face	0,52	0,48	Ns
AIS chest	2,56	2,53	Ns
AIS abdomen	1,83	1,36	ns
AIS pelvis and limbs	2,15	2,51	Ns
AIS ext	0,36	0,20	Ns
PH	7,32	7,30	Ns
Lactate	3,15	3,2	Ns
BE	-4.5	-4,8	Ns
Hb	10,8	11,3	Ns
PTL	196	205	Ns
INR	1,41	1,39	Ns
FIB (claus)	184,6	196	Ns

Blood Products Consumption



Results

PRBCs	2011	2013	Variation
Global Consumption	1048	625	- 423 (- 40%)
Average	8,14	6,51	



Results

Plasma	2011	2013	Variation
Plasma Units	1167	405	- 762 (- 65%)
Average	8,98	4,21	P<0.05



Results

PTL	2011	2013	Variation
Units of PTL	538	258	- 280 (- 52%)
Average	4,14	2,53	P < 0.05

Mortality



Results

Trauma Deaths	2011	2013	Variation
Within 24hrs	8	3	- 5
%	7,4%	4,8%	↓
Hospital Mortality	26	13	- 13
%	20,0%	13,4%	↓

Clinical and mechanistic drivers of acute traumatic coagulopathy

Mitchell Jay Cohen, MD, Matt Kutcher, MD, Britt Redick, BA, Mary Nelson, RN, MPA, Mariah Call, BS, M. Margaret Knudson, MD, Martin A. Schreiber, MD, Eileen M. Bulger, MD, Peter Muskat, MD, Louis H. Alarcon, MD, John G. Myers, MD, Mohammad H. Rahbar, PhD, Karen J. Brasel, MD, MPH, Herb A. Phelan, MD, MSCS, Deborah J. del Junco, PhD, Erin E. Fox, PhD, Charles E. Wade, PhD, John B. Holcomb, MD, Bryan A. Cotton, MD, and Nena Matijevic, PhD, on behalf of the American College of Surgeons, San Francisco, California

BACKGROUND:

Acute traumatic and mechanistic drivers of coagulopathy are not well-explored. The PROspective Observational Study of Trauma (PROS) provided a unique opportunity to characterize

METHODS:

Blood samples were prospectively collected from 147 patients with traumatic injury.

RESULTS:

There was a prevalence of 13% of acute traumatic coagulopathy (ATC) on the basis of a ratio of fibrinogen to fibrin degradation products (F/D) of less than 1.0. ATC was associated with increased bleeding, morbidity, and mortality. The PROspective Observational Study of Trauma (PROS) provided a unique opportunity to characterize

1 PRBC

ISS = 26.2

associated with increased bleeding, morbidity, and mortality. The PROspective Observational Study of Trauma (PROS) provided a unique opportunity to characterize

Plasma clotting factor levels were prospectively measured using comprehensive PROMMTT clinical data. Coagulopathy was defined as an international normalized ratio (INR) of 1.4 or greater. Using international normalized ratio (INR) modeling for international normalized ratio (INR), ISS (OR, 1.03), Glasgow Coma Scale (GCS) score (OR, 0.95), heart rate (OR, 1.08), systolic blood pressure (OR, 0.96), base deficit (BD) (OR, 0.92), and temperature (OR, 0.84) were significant predictors of coagulopathy (all $p < 0.03$). A subset of 165 patients had blood samples collected and coagulation factor analysis performed. Elevated ISS and BD were associated with elevation of aPTT and depletion of factors I, II, V, VIII, and an increase in aPTT drive ATC (all $p < 0.04$). Similar results

Hospital Mortality = 21.4%

LEVEL OF EVIDENCE: Epidemiologic/prognostic study, level IV.

KEY WORDS: PROMMTT; coagulation; bleeding; trauma; injury.

Financial Aspects



Costs for blood components

2011

PRBCs	194.928
Plasma	70.020
PTL	61.870
Overall	326.818

2013

PRBCs	116.250
Plasma	24.300
PTL	29.670
Overall	170.220

- 156.598 € = - 48%



Cost Analysis

Blood Products

-156.598 € = - 48%

Additional costs:	Fibrinogen	39.200
	ROTEM	26.663

Balance + 90.735 € (-28%)