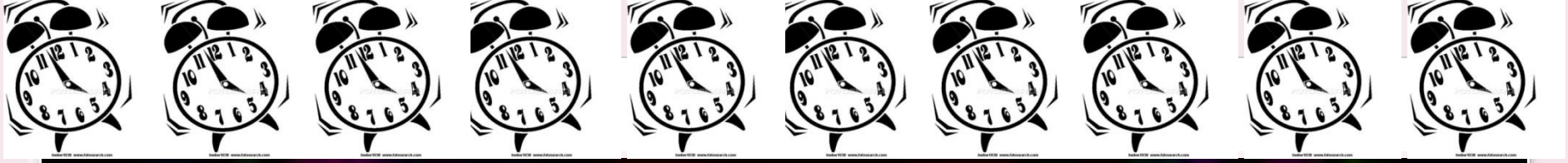
STRATEGIE DI RISPARMIO NEL PAZIENTE EMORRAGICO:USO DEL PLASMA FRESCO CONGELATO

Dr.ssa Vanessa Agostini
Struttura Dipartimentale Medicina Trasfusionale

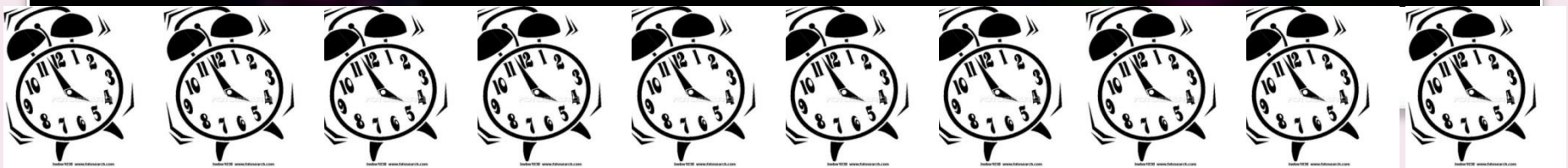
Ospedale M. Bufalini, Cesena

Roma, 22 Settembre 2011



THE TREATMENT OF BLEEDING IS TO STOP BLEEDING!!!!

STOP BLEEDING-STOP TRANSFUSIONS!!!!



UTILIZZO CLINICO DEL PLASMA

Table 1
Fresh Frozen Plasma Transfusion Guidelines

Author	Year	Laboratory Criteria	Dose (mL/kg)
National Institutes of Health[1]	1985	None given	None given
Hong Kong Government Blood Banking Advisory Committee[2]	1990	PT/INR >1.5 times normal	10-15
British Committee for Standards in Haematology[3]	1992	PT/PTT >1.5 times normal; PT >1.8 times normal with liver disease	12-15
Committee Report[4]	1994	PT/PTT >1.5 times normal	15
College of American Pathologists[5]	1994	PT >1.5 times midpoint of normal; PTT >1.5 times upper normal; factor level <25%	2 U (6-7 mL/kg)
American Society of Anesthesiologists[6]	1994	PT/INR >1.5 times normal; factor level <30%	10-15
American College of Obstetrics and Gynecology[7]	1994	PT/PTT >1.5 times normal	2 U (6-7 mL/kg)
Canadian Medical Association Expert Working Group[8]	1997	Significantly increased coagulation time; PT >2.0 with liver disease	10-15
Japanese Ministry of Health and Welfare[9]	1999	PT/PTT >1.5 times normal; factor level <30%	8-12
North Ireland Clinical Resources Efficiency Support Team[10]	2001	PT/PTT >1.5 times normal	12-15
Australia National Health and Medical Research Council[11]	2001	Abnormal coagulation	5-20
American Red Cross[12]	2002	PT/PTT >1.5 times normal	None given
South African National Blood Service[13]	2003	Disturbed coagulation	15-20
British Committee for Standards in Haematology[14]	2004	Multiple factor deficiencies	10-15
New York State Council on Human Blood and Transfusion Services[15]	2004	PT/PTT >1.5 times normal	10-20

INR, international normalized ratio; PT, prothrombin time; PTT, partial thromboplastin time.

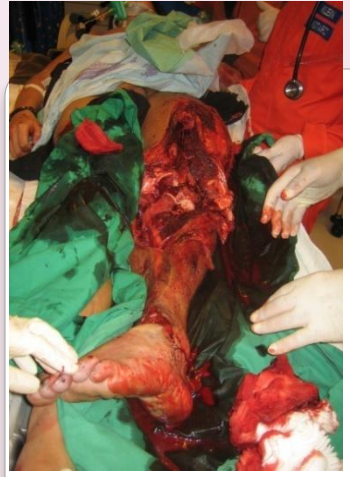
EMORRAGIA

Perdita acuta di sangue circolante. (ATLS)

Volume ematico circolante 7% del peso corporeo, uomo di 70Kg circa 5L: 60% plasma e 40% cellulare (Textbook of Medical Phisiology;Guyton 2006)

Sanguinamento 25mL/min: ipotensione in 1 ora e morte in 2 ore

Sanguinamento 100mL/min: ipotensione in 15 min e morte in 30 min



Emorragia massiva o trasfusione massiva?

- **Trasfusione di > 3000 ml; o > 10 U EC in 24 ore**
- **Perdita dell'intero volume ematico in 24 ore**
- **Perdita del 50% del volume ematico in 3 ore**
- **Trasfusione di 4 o più U di EC in un'ora**
- **Sanguinamento > 150 ml/min**

BCSH British Journal of Haematology 2006;135:634
Crosson JY Clin Lab Med 1996;16:873
Erber WN Trasnfusione and Apheresis Science: 2002;27:83

Tabella 2 – Risposta alla reinfusione iniziale[1]

	RISPOSTA RAPIDA	RISPOSTA TRANSITORIA	NESSUNA RISPOSTA
Parametri vitali	Ritornano alla norma	Transitorio miglioramento; poi ricomparsa di ↓PA e ↑FC	Rimangono alterati
Perdita ematica stimata	Minima (10-20%)	Modesta ed in atto (20-40%)	Grave (>40%)
Necessità di ulteriore infusione di cristalloidi	Bassa	Elevata	Elevata
Necessità emotrasfusioni	Bassa	Da moderata a elevata	Immediata
Sangue da utilizzare	Sangue con gruppo e prove crociate	Sangue tipo-specifico	Sangue per emergenze
Necessità di intervento chirurgico	Possibile	Probabile	Altamente probabile
Precoce presenza del chirurgo	Sì	Sì	Sì

Shock

Disponibilità di ossigeno NON adeguata alla richiesta metabolica

La gravità e la durata dello shock porta ad un DEBITO di O2 associato a metabolismo anaerobio e acidosi tissutale (ATLS cap. 3)

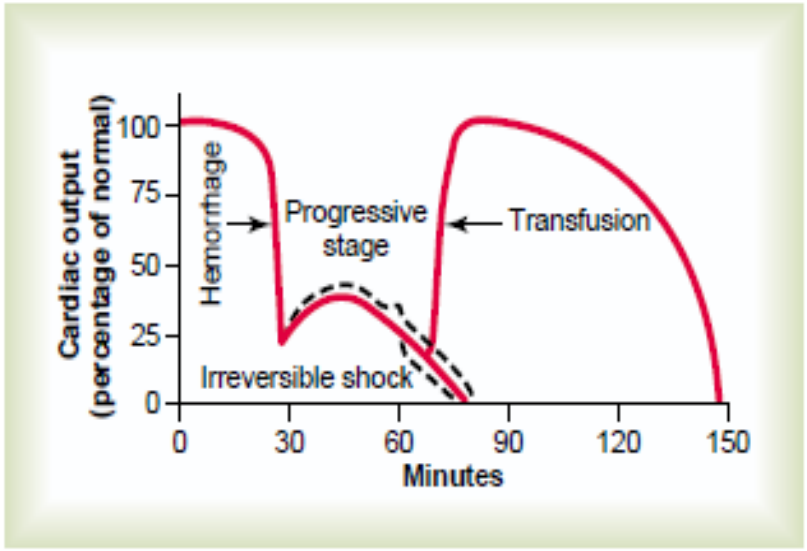
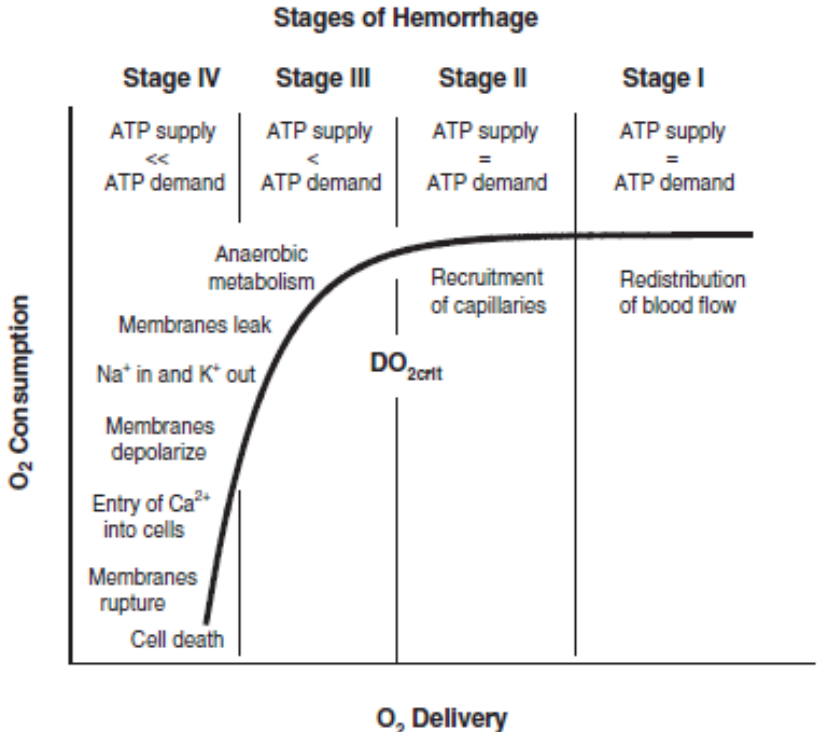


Figure 24–6

Failure of transfusion to prevent death in irreversible shock.

Chapter 24 *Circulatory Shock and Physiology of Its Treatment*

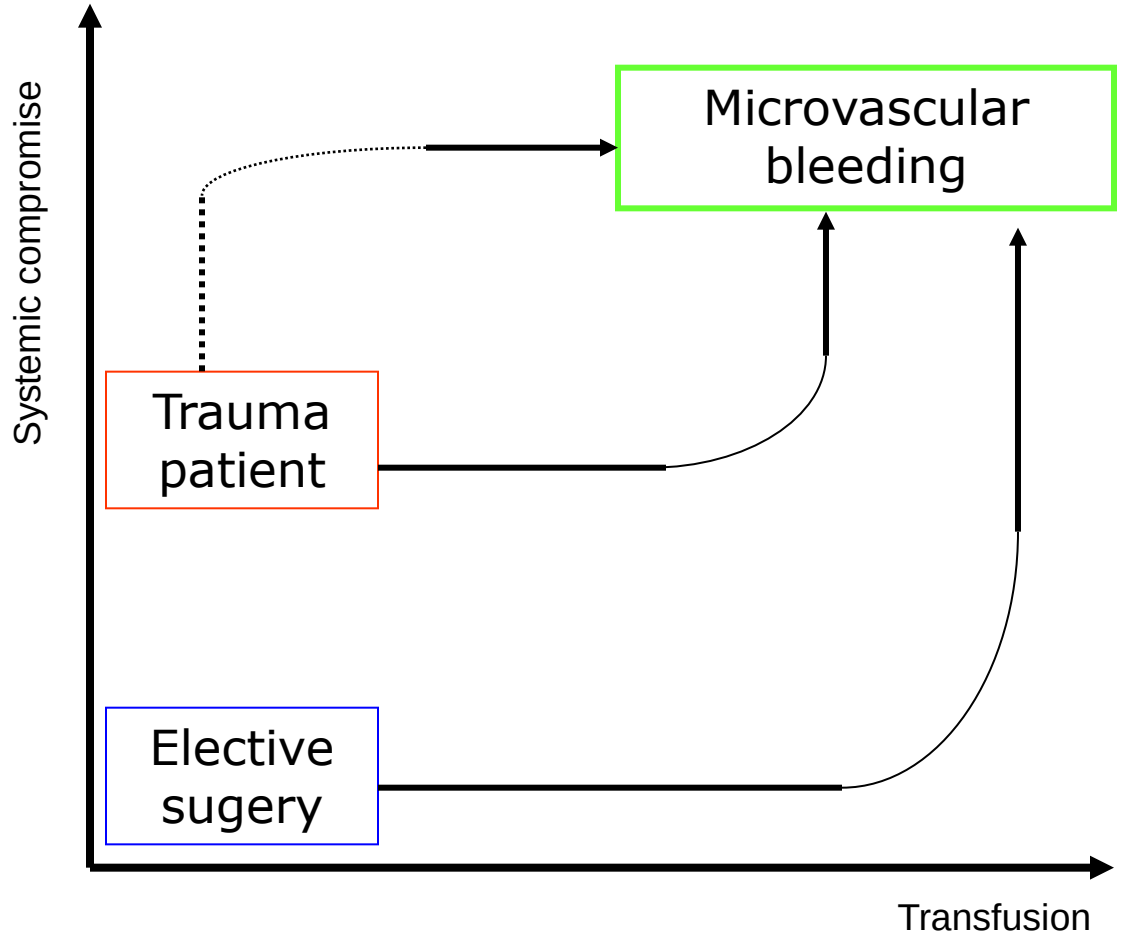
Arthur C. Guyton



Review

Clinical review: Hemorrhagic shock

THE ROADS TO COAGULOPATHY

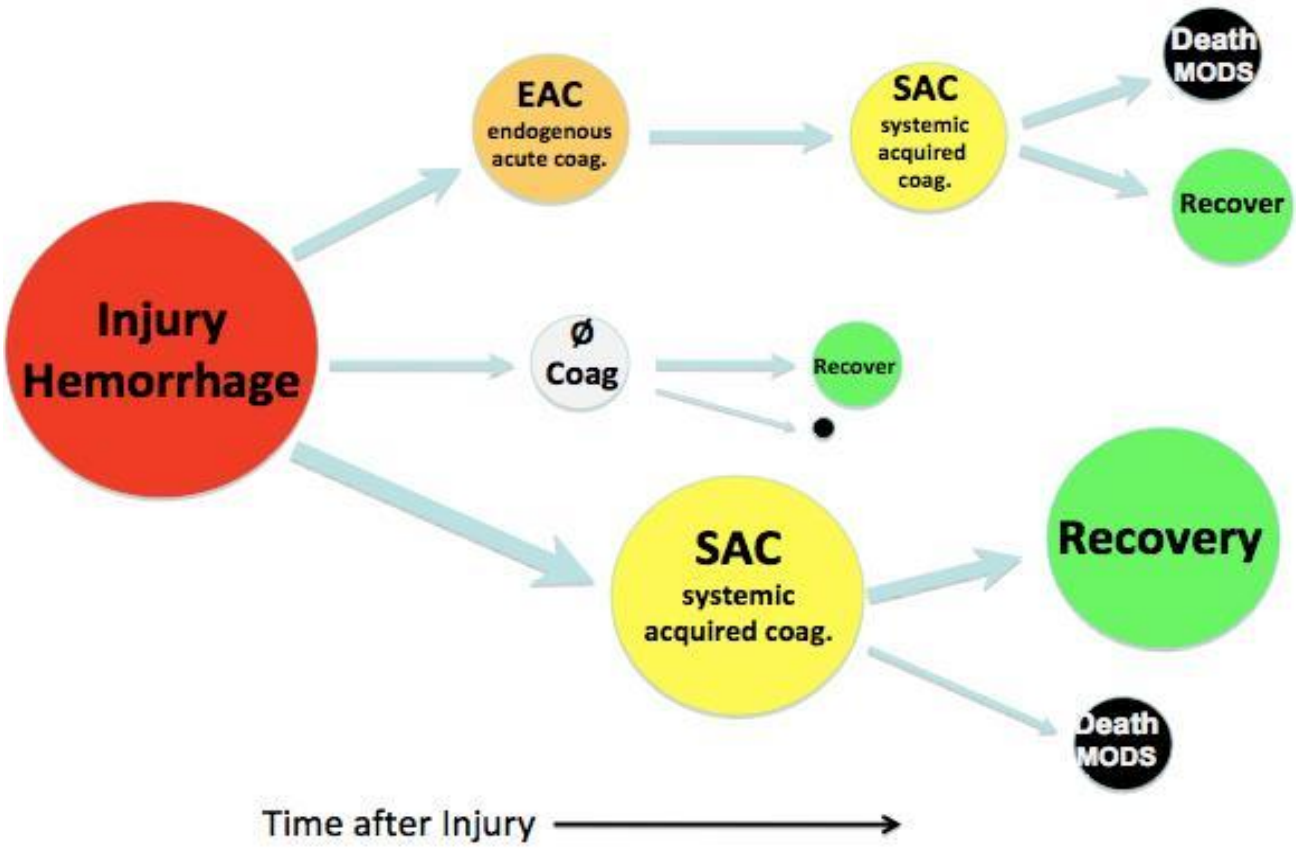


The coagulopathy of massive transfusion

J.-F. Hardy,[1] P. de Moerloose[2] & C. M. Samama[3]

Vox Sanguinis (2005) **89**, 123–127

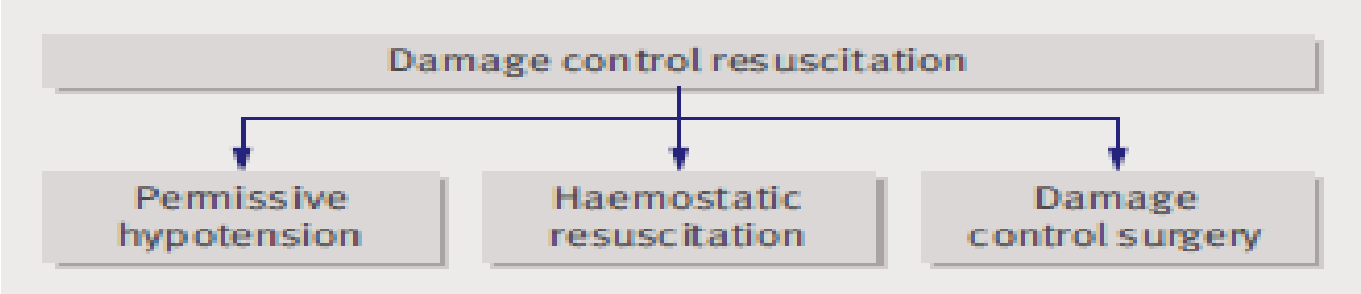
Acute Traumatic Coagulopathy: From Endogenous Acute Coagulopathy to Systemic Acquired Coagulopathy and Back

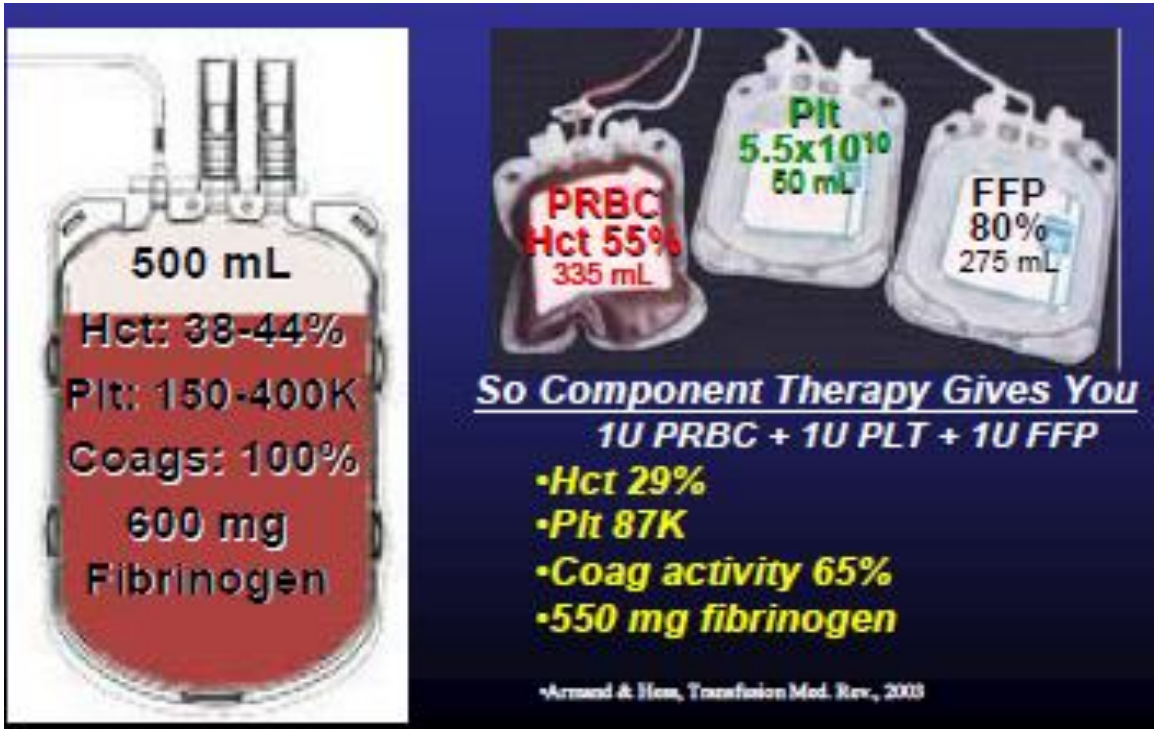


The Journal of **TRAUMA**® *Injury, Infection, and Critical Care* • Volume 70, Number 5, May Supplement 2011

Damage control resuscitation for patients with major trauma

BMJ | 13 JUNE 2009 | VOLUME 338





CODE RED TRAUMA- MAJOR HAEMORRHAGE

1) Senior member of trauma team leader **MUST** declear CODE RED if:

- SP<90 mmHg

- poor response to initial fluid resuscitation

- suspected active haemorrhage

2) Nominate a member of team to call the blood bank to activate CODE RED

3) Request:

- either CODE RED PACK A (6RBC, 4FFP) or CODE RED PACK B (6RBC, 4FFP, 1Plt, 2 CRYO)

Efficacy of standard dose and 30 ml/kg fresh frozen plasma in correcting laboratory parameters of haemostasis in critically ill patients

 British Journal of Haematology, **125**, 69–73

Table II. PT, aPTT and coagulation factor levels before and after the infusion of FFP.

	Group 1			Group 2		
	Preinfusion	Postinfusion	Observed increment	Preinfusion	Postinfusion	Observed increment
PT (s)	22·8 (17–222)	19 (15–36)		24 (17–44)	16 (14–20)	
aPTT (s)	46·4 (30–223)	37 (30–158)		41 (28–198)	30** (24–45)	
FI (g/l)	2·7 (0·2–4·4)	3·4 (0·2–7·2)	0·4 (−1·5–2·9)	1·5 (0·4–4·5)	2·7 (1·7–4·1)	1·0 (−0·9–2·4)
FII (IU/dl)	36·5 (22–65)	56 (43–76)	16 (7–42)	35 (16–73)	83** (60–102)	41* (15–61)
FV (IU/dl)	36 (2–126)	58 (14–121)	10 (−4·7–37)	41 (10–99)	69 (39–119)	28* (−16–51)
FVII (IU/dl)	43 (6·6–99)	55 (17–114)	11 (4–32)	48 (16–91)	85** (54–127)	38* (−3–75)
FVIII (IU/dl)	146 (8–391)	159 (18–360)	10 (−49–46)	157 (58–535)	175 (120–313)	17 (−250–96)
FIX (IU/dl)	83 (29–165)	98 (41–167)	8 (−6–30)	73 (43–174)	114 (65–156)	28* (−35–53)
FX (IU/dl)	49 (28–133)	61 (50–94)	15 (−73–43)	53 (16–94)	88** (65–104)	37* (−5–65)
FXI (IU/dl)	38 (20–105)	48 (38–101)	9 (−4·3–32)	34 (15–58)	55** (41–80)	23* (6–37)
FXII (IU/dl)	39 (27–64)	57 (44–83)	30 (1–37)	30 (5–69)	73** (60–105)	44* (23–66)

The median and 10th and 90th percentiles for PT, apt and coagulation factor levels in groups 1 and 2 before and after FFP infusion and observed increments are shown. The coagulation factor levels were not statistically different between the two groups before the infusion.

*Observed increment in group 2 was significantly greater than group 1 (Mann–Whitney *U*-test, $P < 0·05$).

**Significant difference when comparing groups 1 and 2 post-transfusion (Mann–Whitney *U*-test, $P < 0·05$).

Transfusion packages for massively bleeding patients: The effect on clot formation and stability as evaluated by Thrombelastograph (TEG®)

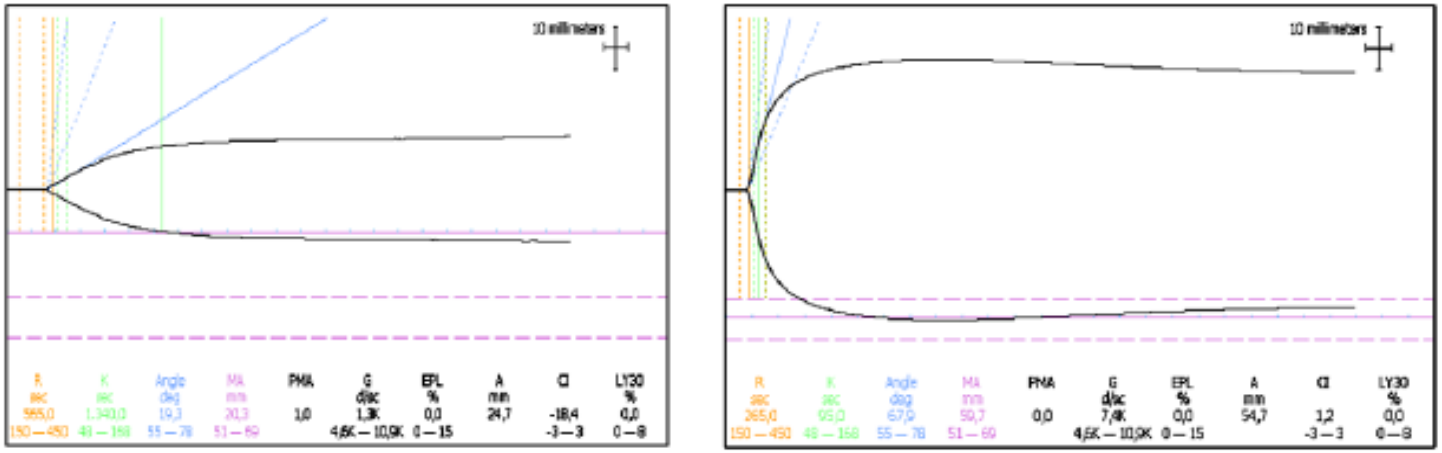


Fig. 2. Representative Thrombelastograph (TEG®) tracing before (A) and after (B) administration of a transfusion package.

	Before TP[a]	After TP
R time (3–8 min)	6.7 (3.7–9.4)	6.0 (4.8–7.6)
Angle (α) (55–78°)	58.9(48.1–71.5)	*63.3 (53.1–72.4)
MA (51–69 mm)	48.9 (44.3–63.7)	*59.3 (56.5–65.9)
G (4.6–10.9 d/sc)	4.8 (4.0–8.8)	*7.3 (4.6–9.6)
Ly30 (0–8%)	0	0
Hypocoagulable patients (no.)	6	**0

[a] TP; Transfusion package, *R*-time (min); Angle (°); MA (mm); *G* (d/sc); Ly30 (%) together with ^*R* time >8 min ($n = 2$), Angle < 55° ($n = 1$), MA < 48.9 mm ($n = 6$), $G < 4.6$ d/sc ($n = 3$).
* Difference between TEG parameters before TP, $p < 0.05$.
** Difference between TEG parameters after TP, $p = 0.01$.

Table 1. Features of different SD plasma products

Type of plasma	Source and quality	Pool size	Inactivation time and temperature	Removal of abnormal prion binding protein (PrP^{Sc})	Final product
Octaplas (Austria)	high-quality apheresis or recovered plasma*	380 l (630 apheresis units or 1,520 recovered units)	4 h at 30 °C (1% TNBP + 1% Triton X-100)	2.5 log reduction of PrP^{Sc} as a result of the SD manufacturing process	200 ml frozen in plastic bags
OctaplasLG (Austria)	high-quality apheresis or recovered plasma*	380 l (630 apheresis units or 1,520 recovered units)	1–1.5 h at 30 °C (1% TNBP + 1% Triton X-100)	> 5 log reduction of PrP^{Sc} after additional affinity chromatography with PrP^{Sc} binding ligand	200 ml frozen in plastic bags
Plasmasafe (Italy)	high-quality apheresis or recovered plasma*	380 l (630 apheresis units or 1,520 recovered units)	4 h at 30 °C (1% TNBP + 1% Triton X-100)	not documented, but probably similar to Octaplas	200 ml frozen in plastic bags
Plasma viro-atténué Solvant détergent (France)	high-quality apheresis plasma	60 l (100 apheresis units)	4 h at 30 °C (1% TNBP + 1% Triton X-100)	not documented, but probably similar to Octaplas	200 ml frozen in plastic bags
Bioplasma FDP (South Africa)	high-quality recovered plasma	200 l	4 h at 30 °C (1% TNBP + 1% Triton X-100)	not documented, but probably similar to Octaplas	50 and 200 ml lyophilized in glass bottles
PLAS+SD (USA)	recovered plasma frozen next day	650 l (2,500 recovered units)	4 h at 30 °C (1% TNBP + 1% Triton X-100)	not documented, but probably similar to Octaplas	200 ml frozen in plastic bags (produced from 1998 to 2002)
'Mini-pool' (for blood bank application in resource limited countries)	recovered plasma	5–10 l	4 h at 31 °C (1% TNBP + 1% Triton X-45) or 4 h at 37 °C (2% TNBP)	unknown	depending upon local practice

*Except Octaplas specially produced for Ireland where recovered US plasma of similar quality as that for PLAS+SD was used.

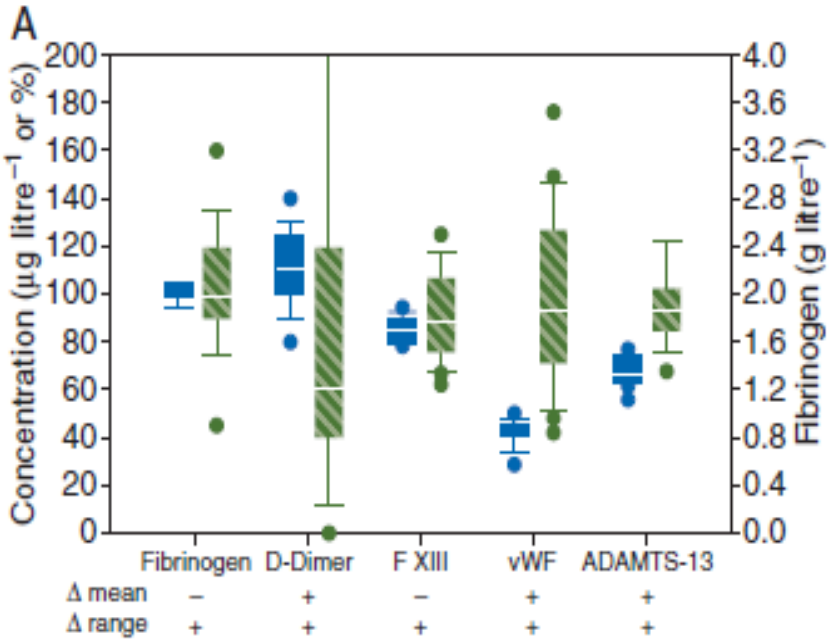
Relative concentrations of haemostatic factors and cytokines in solvent/detergent-treated and fresh-frozen plasma

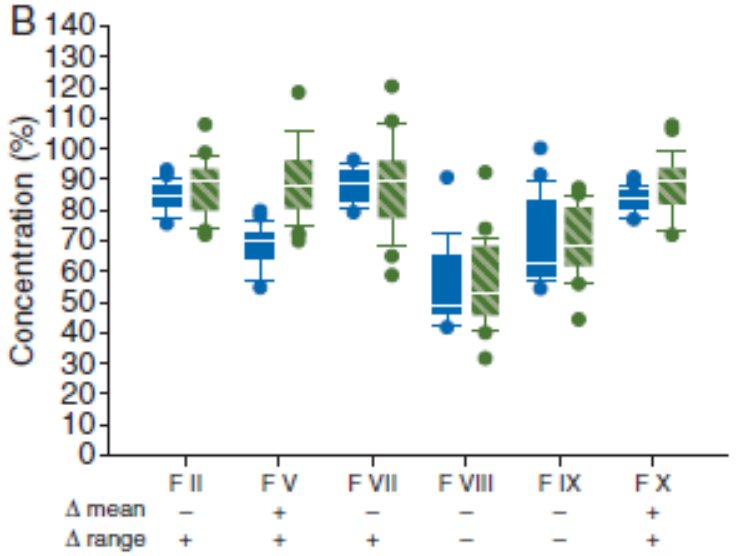
British Journal of Anaesthesia **106** (4): 505–11 (2011)

Table 1 Reference ranges and measured values in SDP and FFP. Values are presented as mean; median (minimum; maximum); and mean and variances of the individual parameters. *$P<0.01$; **$P<0.001$

Haemostatic parameters/ cytokines	Number of samples outside the normal range, SDP; FFP	Reference range	SDP	FFP
Fibrinogen (g litre^{-1})	0; 1	1.5–4.0	2.0; 2.0 (1.9; 2.1)	2.0; 2.0 (0.9; 3.2)**
D-Dimer (μg litre^{-1})	0; 1	<500	110; 110 (80; 140)	130*; 60 (0; 1250)*
F XIII (%)	0; 4	70–140	86; 85 (79; 95)	91; 89 (62; 126)**
vWF (%)	24; 2	50–200	43; 44 (29; 50)	97**; 93 (43; 176)**
ADAMTS-13 (%)	1; 0	60–130	68; 66 (56; 78)	94**; 93.0 (68; 123)**
F II (%)	0; 0	60–150	84; 84 (75; 93)	87; 90 (72; 108)*
F V (%)	0; 0	50–150	69; 70 (55; 80)	89**; 88 (70; 108)*
F VII (%)	0; 0	60–150	88; 89 (79; 96)	88; 90 (59; 120)**
F VIII (%)	15; 9	50–200	65; 49 (42; 191)	56; 53 (32; 92)
F IX (%)	0; 1	50–200	74; 63 (55; 134)	70; 68 (45; 87)
F X (%)	0; 0	60–150	84; 84 (77; 91)	89*; 88 (72; 108)*
TNF-α (pg ml^{-1})	0; 0	<6.3	0.65; 0.58 (0.40; 1.23)	1.03**; 0.80 (0.43; 3.55)*
IL-1 (pg ml^{-1})	0; 0	<3.9	0.10; 0.00 (0.00; 1.00)	0.00**
IL-6 (pg ml^{-1})	0; 0	<3.1	0	0.15; 0 (0.00; 2.00)**
IL-8 (pg ml^{-1})	13; 24	<0.1	0.29; 0.11 (0.00; 2.00)	1.28**; 1.01 (0.00; 5.00)*
IL-10 (pg ml^{-1})	0; 3	<8.0	1.20; 0.70 (0.10; 4.50)	4.66**; 4.90 (0.60; 12.80)*

Relative concentrations of haemostatic factors and cytokines in solvent/detergent-treated and fresh-frozen plasma





Blue=SDP

Green=FFP

British Journal of Anaesthesia **106** (4): 505–11 (2011)

SCANDINAVIAN GUIDELINES – "THE MASSIVELY BLEEDING PATIENT"

Another serious complication is Transfusion Associated Lung Injury (TRALI), an acute lung insufficiency that can be induced by:

- HLAantibodies in plasma of transfusion products, mainly from female multiparae donors. This source has been reduced by the use of pooled fresh frozen plasma (FFP) (Octaplas®) and avoiding FFP from multiparae donors. HLA antibodies in cellular blood products can also induce TRALI, although rarely
- Cytokines and vasoactive substances from dead cells in cellular products. This source is reduced, but not eliminated, by in-production leukocyte filtration of all cellular blood products.

GUIDELINES Scandinavian Journal of Surgery 97: 15–36, 2008

Recommendations from the Tuscan Transfusion System on the appropriate use of solvent/detergent-inactivated fresh-frozen plasma

Blood Transfus 2008; 6: 25-36

3. Prevention of transfusion-related acute lung injury (TRALI)

Indications. The use of S/D FFP is suggested for the prevention of TRALI in patients with pre-existing lung damage treated in an intensive care setting, for the treatment of TTP, in the case of massive transfusion, sepsis, solid organ or bone marrow transplantation, during induction therapy for haematological neoplasms and during hearth surgery with extracorporeal circulation and high FFP consumption. Grade of recommendation: 2C+.

Fresh Frozen Plasma Should be Given Earlier to Patients Requiring Massive Transfusion

J Trauma. 2007;62:112–119.

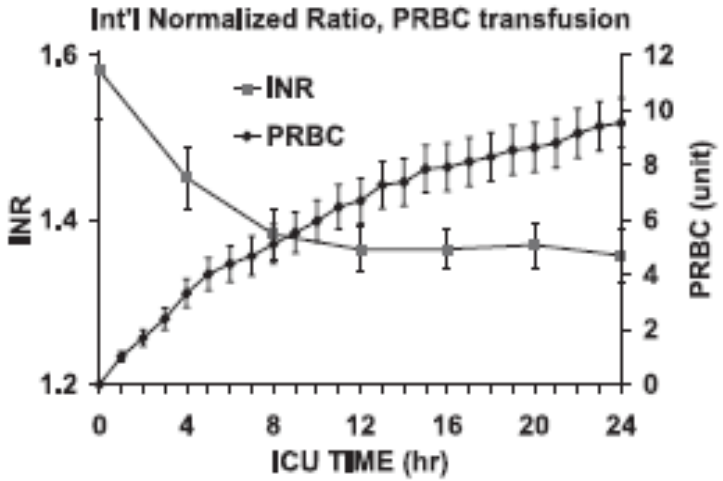


Fig. 6. *International normalized ratio (INR) and cumulative PRBC transfusion during ICU resuscitation showing persistent moderate coagulopathy (INR ~1.4) and concurrent ongoing transfusion requirement.*

Damage Control Hematology: The Impact of a Trauma Exsanguination Protocol on Survival and Blood Product Utilization

J Trauma. 2008;64:1177–1183.

Table 2 Univariate Analyses of Primary and Secondary Outcome Measures

Variable	Pre-TEP (n = 117)	TEP (n = 94)	*p*
30-d mortality (%)	65.8	51.1	0.030*
24-h blood product use (units)	39 ± 28	31.8 ± 19	0.017*
24-h RBC use (units)	19.8 ± 12.8	18.8 ± 11.2	0.695
24-h FFP use (units)	12.4 ± 12.5	9.9 ± 7	0.595
24-h PLT use (units)	6.8 ± 7.2	3.1 ± 3.7	<0.001*
Intraoperative RBC use (units)	11.1 ± 8.5	16 ± 11.4	0.001*
Intraoperative FFP use (units)	4.3 ± 4	8.2 ± 6.8	<0.001*
Intraoperative PLT use (units)	1.1 ± 2.6	2.2 ± 2.3	<0.001*
Intraoperative crystalloid (L)	6.7 ± 4.2	4.9 ± 3.0	0.002*
Unexpected survivors (%)	5.1	22.3	<0.001*
Unexpected deaths (%)	22.2	8.5	0.007*

* Statistically significant at $p < 0.05$.

TEP, trauma exsanguination protocol; RBC, red blood cell; FFP, fresh frozen plasma; PLT, platelets.

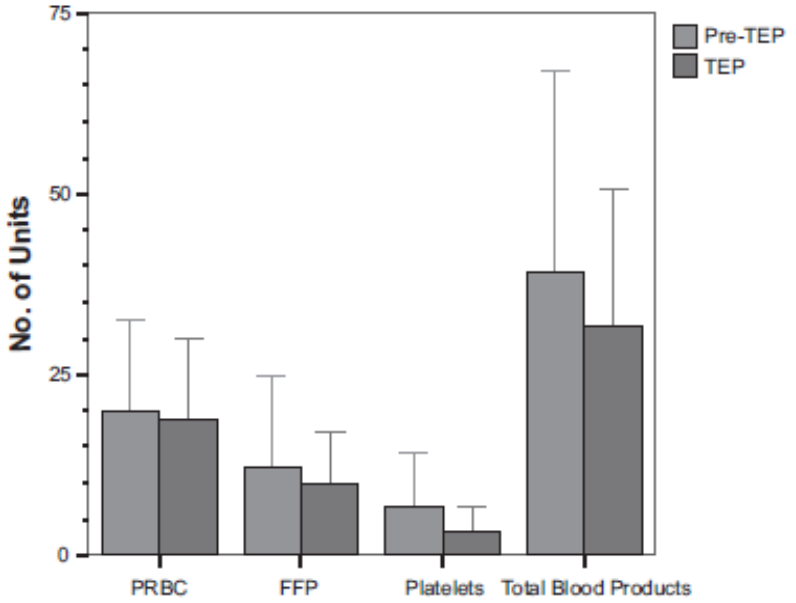


Fig. 1. *Unadjusted initial 24-hour blood product utilization before and after implementation of TEP. Each bar corresponds to the mean number of units transfused + standard deviation.*

Trauma exanguination protocol (TEP): **10 PRBC, 4 FFP, 2 Plt**

Increased Plasma and Platelet to Red Blood Cell Ratios Improves Outcome in 466 Massively Transfused Civilian Trauma Patients

TABLE 3. Blood Component Transfusions by Plasma and Platelet Ratios

	High Plasma		Low Plasma		
	High Platelets (n = 151)	**Low Platelets (n = 101)**	**High Platelets (n = 83)**	**Low Platelets (n = 131)**	***P***
FFP (units)	17 ± 12	16 ± 10	7 ± 5	6 ± 6	<0.001
Platelets (units)	20 ± 16	5 ± 6	18 ± 10	4 ± 6	<0.001
RBC (units)	22 ± 17	21 ± 12	21 ± 11	21 ± 12	0.91
Crystalloid (L)	14 ± 10	13 ± 7	17 ± 12	11 ± 10	<0.001
FFP:RBC ratio	0.8 ± 0.3	0.8 ± 0.3	0.3 ± 0.1	0.2 ± 0.1	<0.001
Platelet:RBC ratio	0.9 ± 0.4	0.2 ± 0.2	0.9 ± 0.4	0.1 ± 0.2	<0.001
Crystalloid:RBC ratio	0.8 ± 0.5	0.8 ± 0.6	0.9 ± 0.6	0.6 ± 0.5	<0.001
Received rFVIIa (%)	34 (22)	11 (11)	21 (25)	15 (12)	0.006

High plasma or platelet to RBC ratio ≥1:2. Low plasma or platelet to RBC ratio <1:2.
FFP indicates fresh frozen plasma.

(*Ann Surg* 2008;248: 447–458)

Increased Plasma and Platelet to Red Blood Cell Ratios Improves Outcome in 466 Massively Transfused Civilian Trauma Patients

TABLE 4. Survival, Cause of Death, and Clinical Outcomes by Plasma and Platelet Ratio

	High Plasma (%)		Low Plasma (%)		
	High Platelets (n = 151)	Low Platelets (n = 101)	High Platelets (n = 83)	Low Platelets (n = 83)	*P*
Survival (%)	71	52	66	41	<0.001
Survival at 6 h	98	86	83	58	<0.001
Survival at 24 h	87	75	77	50	<0.001
Survival at 30 d	73	54	68	43	<0.001
Median time-to-death, (hours)	35	18	6	4	<0.001
Cause of death					
Truncal hemorrhage (%)	10	25	22	44	<0.001
Head injury	13	15	6	14	0.3
MOF	5	7	6	3	0.45
Airway	0	1	2	2	0.24
Other	3	6	4	4	0.85
Clinical outcomes					
Hospital-free days	6 ± 8	3 ± 6	5 ± 8	3 ± 7	<0.001
ICU-free days	5 ± 7	3 ± 6	6 ± 7	4 ± 7	<0.001
Ventilator-free days	6 ± 8	2 ± 5	7 ± 8	4 ± 7	<0.001

High plasma- or platelet-to-RBC ratio ≥1:2. Low plasma- or platelet-to-RBC ratio <1:2.

(*Ann Surg* 2008;248: 447–458)

The North Pacific Surgical Association

The American Journal of Surgery (2009) 197, 565–570

A high ratio of plasma and platelets to packed red blood cells in the first 6 hours of massive transfusion improves outcomes in a large multicenter study

Table 3 Mortality differences and respiratory outcome based on the ratio of blood products

Product ratio	Measure	Transfusion ratio in first 6 hours <1:4	1:4-1:1	≥1:1	*P*
FFP:PRBC	6 hour mortality %	37.3*	15.2*	2.0*	<0.001
	In-hospital mortality %	54.9*	41.1*	25.5*	<0.04
	Ventilator free days†	9	7.9	6.3	0.35
PLT:PRBC	6 hour mortality %	22.8	19.0	3.2*	<0.002
	In-hospital mortality %	43.7	46.8	27.4*	<0.03
	Ventilator-free days†	6*	9.9**	9.1**	<0.004

*Significant difference from other two ratios.
**P = non-significant (0.79).
†Massive transfusion patients who survived >30 days (n = 277).
Fisher exact test.

PRBC 24h: **18**

P<.001

PRBC 24h: **13**

Effect of High Product Ratio Massive Transfusion on Mortality in Blunt and Penetrating Trauma Patients

Susan E. Rowell, MD, Ronald R. Barbosa, MD, Brian S. Diggs, PhD, Martin A. Schreiber, MD, and the Trauma Outcomes Group

TABLE 5. Secondary Outcomes by Mechanism and FFP:RBC Ratio

	Blunt Mechanism			Penetrating Mechanism		
Variable	**<1:2 Ratio**	**≥1:2 Ratio**	***p***	**<1:2 Ratio**	**≥1:2 Ratio**	***p***
Units PRBC/24 h	18.0 (12.0–27.1)	15.0 (12.0–22.0)	0.09	17.0 (12.9–28.0)	19.0 (12.8–29.3)	0.04
L crystalloid/24 h	11.0 (6.0–18.6)	11.2 (8.0–16.0)	0.59	10.8 (7.1–19.7)	10.7 (7.8–15.8)	0.70

Values expresses as median ± IQR.

Esclusi i deceduti entro 30 min

TABLE 6. Secondary Outcomes by Mechanism and Platelet:RBC Ratio

	Blunt Mechanism			Penetrating Mechanism		
Variable	**<1:2 Ratio**	**≥1:2 Ratio**	***p***	**<1:2 Ratio**	**≥1:2 Ratio**	***p***
Units PRBC/24 h	16.0 (12.0–25.2)	18 (12.5–24.0)	0.23	17.0 (13.0–27.5)	20.0 (12.0–30.8)	0.60
L crystalloid/24 h	9.8 (6.0–16.0)	13 (8.9–19.0)	<0.01	10.0 (6.5–18.0)	11.2 (8.0–16.2)	0.32

Values expressed as median ± IQR.

(*J Trauma*. 2011;71: S353–S357)

Transfusion and Apheresis Science xxx (2011) xxx–xxx

Change in transfusion practice in massively bleeding patients

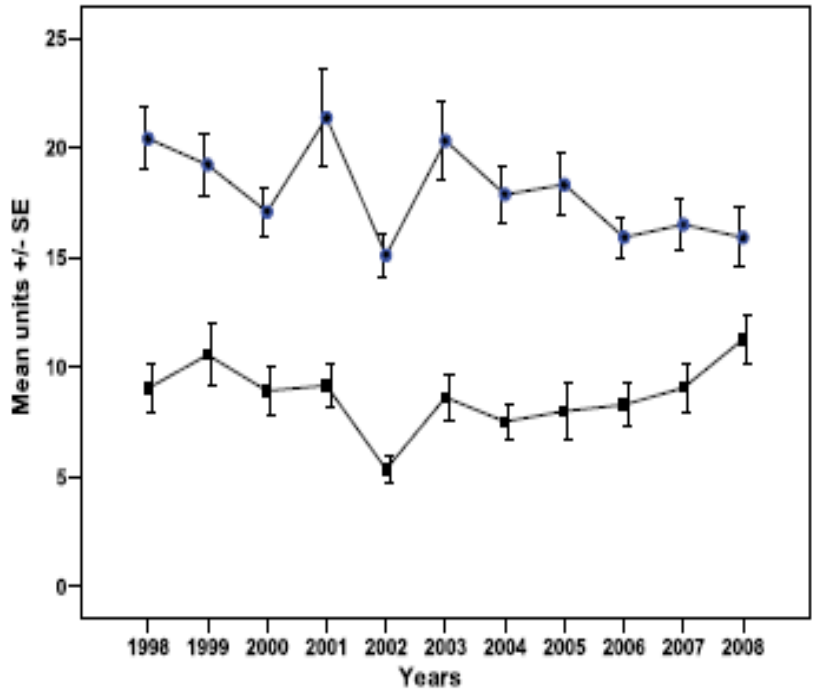


Fig. 1. Mean RBC (●) and FFP (■) units transfused by year. The mean number of RBC units transfused was 20.4 ± 9.8 in 1998 and 15.9 ± 8.0 in 2008 ($p = 0.09$).The mean number of FFP units transfused increased from 9 .0 ± 7.9 in 1998 to 11.3 ± 6.7 in 2008 ($p = 0.03$).

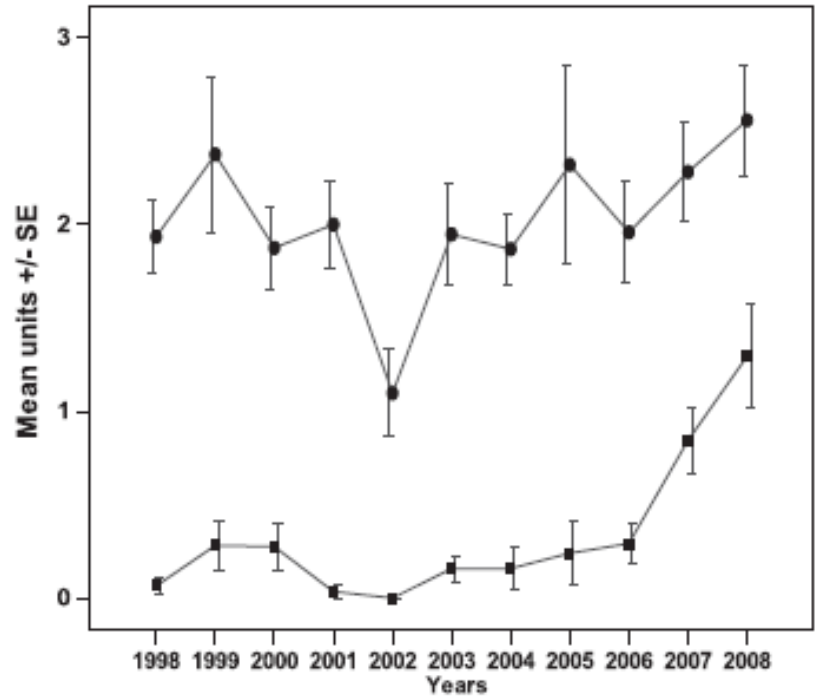


Fig. 2. Mean platelet (●) and cryoprecipitate (■) units by year. the mean number of platelet units increased from 1.9 ± 1.3 in 1998 to 2.6 ± 1.7 in 2008 ($p = 0.02$). The mean units of cryoprecipitate increased from 0.03 ± 0.19 in 1998 to 1.3 ± 1.6 in 2008 ($p = 0.001$).

Proactive administration of platelets and plasma for patients with a ruptured abdominal aortic aneurysm: evaluating a change in transfusion practice

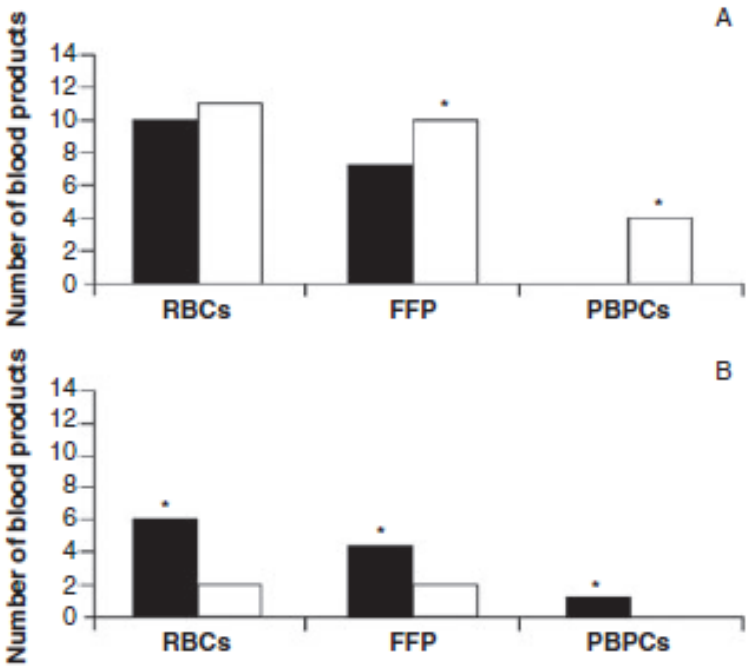


Fig. 1. Surgical (A) and ICU (B) transfusions for patients operated for an rAAA. Values are median and range for 82 (■, control group) and 50 patients (□, intervention group). Difference among groups, *$p < 0.05$.

Intraoperative Platelet and Plasma Improves Survival in Patients Operated for a rAAA: A Follow-up Evaluation

Table 2 Outcome data for patients operated for a ruptured abdominal aortic aneurysm

	Follow-up group	Intervention group	Control group
Year	2006–2007	2004–2005	2002–2004
Transfusions intraoperatively (No)			
RBC	10 (3–24)	12 (2–40)	10 (4–65)
FFP	12 (4–24)	11 (2–42)	*7 (0–46)
PC	5 (3–11)	4 (2–16)	*0 (0–3)
Transfusions postoperatively (No.)			
RBC	2 (0–20)	3 (0–31)	*6 (0–54)
FFP	2 (0–10)	2 (0–12)	*4 (0–32)
PC	0 (0–5)	0 (0–4)	*1 (0–6)
Laboratory values at admission to ICU			
Haemoglobin (g/L) Median (range)	122 (78–150)	123 (72–171)	121 (105–134)
Platelet count ($\times 10^9$/L)	158 (77–286)	155 (31–557)	*69 (29–236)
APTT (s)	36 (20–124)	39 (22–130)	*44 (28–145)
INR (arbitrary units)	1.2 (0.8–3.9)	1.3 (0.9–4.2)	1.3 (1.0–2.1)
S-Creatinine (mg/dL)	1.3 (0.65–7.3)	1.3 (0.52–9.2)	*1.7 (0.91–5.2)
Length of stay (LOS)			
ICU (d)	5.5 (0–22)	6.3 (0–26)	4.2 (0–33)
Hospital (d)	11.1 (1–47)	12.0 (1–42)	10.0 (1–86)

Activated partial thromboplastintime (APTT); prothrombintime (PT); all values for arrival at the intensive care unit (ICU) after surgery. Data are median and range. *difference between the follow-up and intervention vs. control group ($p < 0.05$).

Eur J Vasc Endovasc Surg (2008) 36, 397–400

Management of Abdominal Aortic Aneurysms Clinical Practice Guidelines of the European Society for Vascular Surgery

Eur J Vasc Endovasc Surg (2011) 41, S1—S58

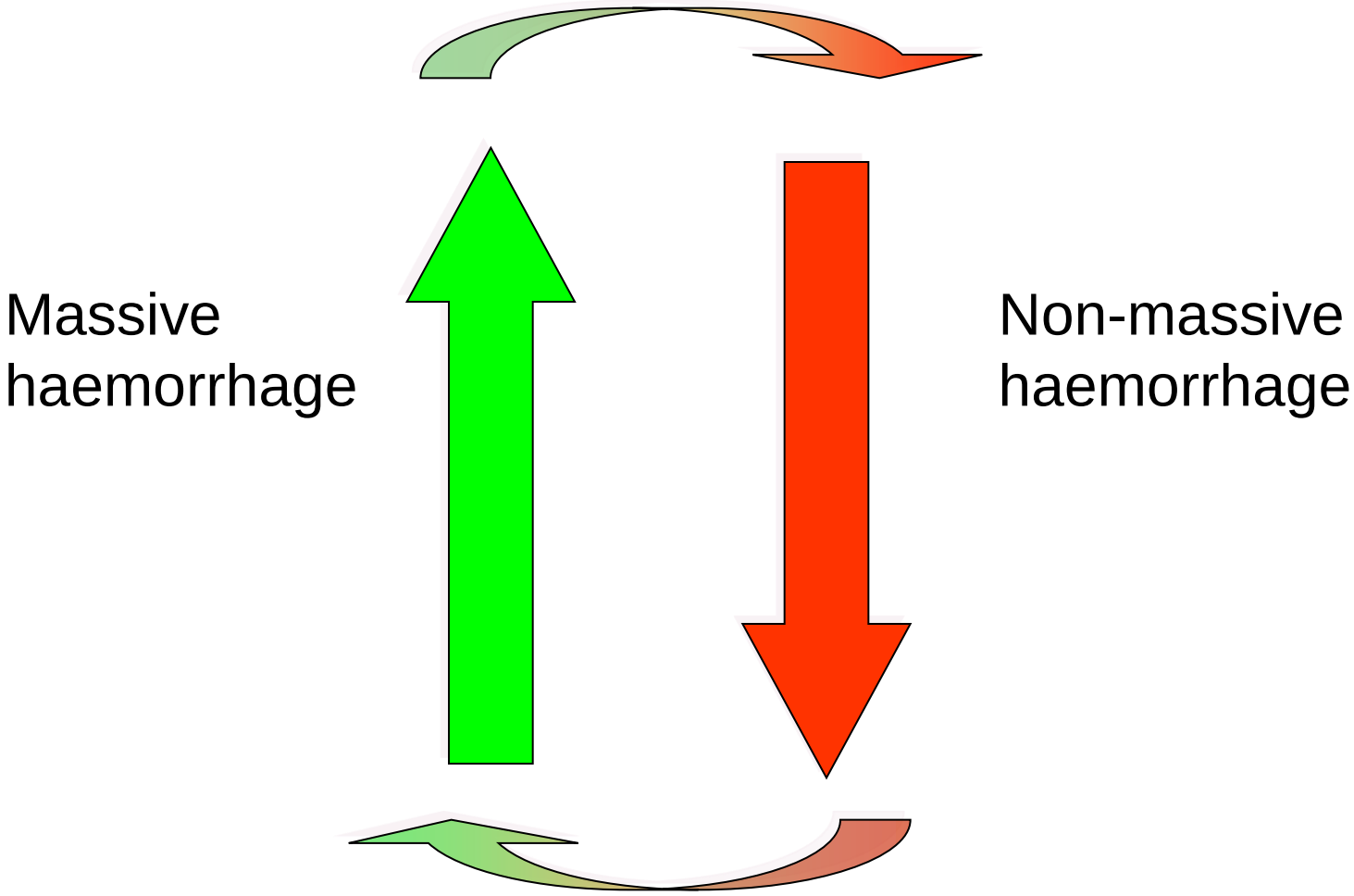
esvs Journal

Resuscitation

Approximately 25% of patients with rAAA will arrive in an hypotensive state. Fluid resuscitation should be restricted to an amount needed to maintain patient's consciousness and systolic blood pressure of 50—100 mm Hg (permissive hypotension). Experience has shown that systolic arterial pressures of 50—70 mm Hg are well tolerated for short periods and limit internal bleeding and its associated loss of platelets and clotting factors.[402,425—428] Resuscitation efforts should be preferentially managed with the use of blood products.

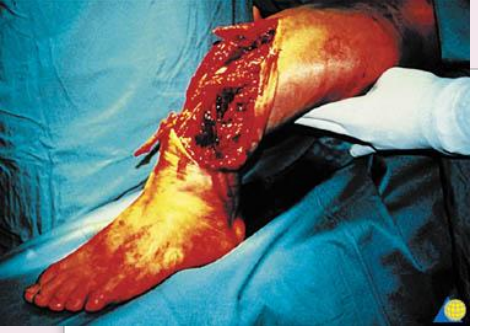
Whether or not pharmacological lowering of blood pressure is beneficial remains to be conclusively shown.

TRANSFUSION STRATEGY



HAEMOSTATIC RESUSCITATION VS RESTRICTIVE TRANSFUSIONS

IPOTESI CHE GENERANO POSSIBILITA’



fractures | organ/soft tissue injuries | hypoxia/hypotension | operative trauma | infection

tissue damages

antigens

toxins

pain stress

APC

Ag

T_H

Ag-presentation

neuroendocrine reaction

TNF-α, IL-1β, IL-6, IL-8, IL-12, IL-18, MMF, HMG-1, G-CSF, GM-CSF, PGE_2, LTB_4, TXA_2, PAF

T_H1: IL-2, IFN-γ, TNF-β

T_H2: IL-4, IL-10, IL-13, TGF-β

SIRS

CARS

complement cascade

kallikrein-kinin-system

coagulation system

acute phase reaction

adhesion of leukocytes

PMNL - respiratory burst

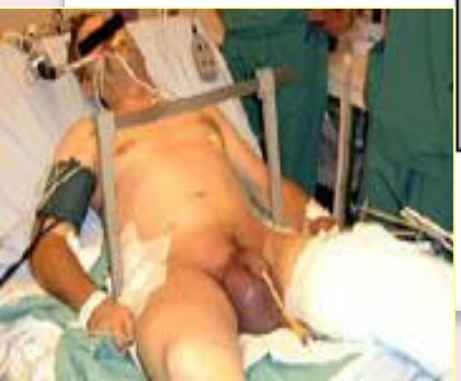
immuno-suppression

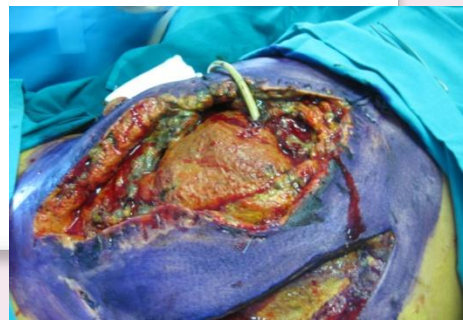
hypermetabolism

susceptibility to infections

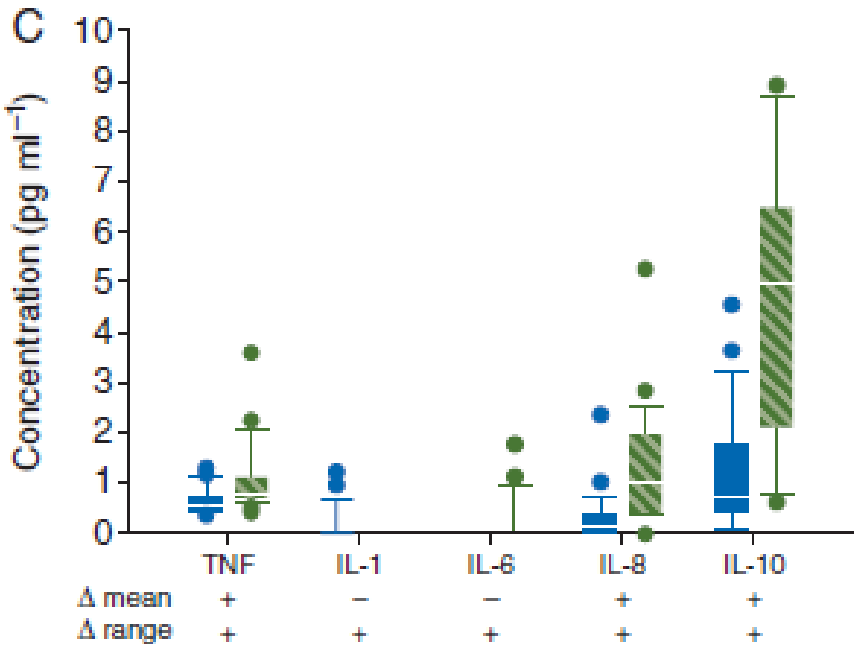
endothelial + parenchymal cell damages

MODS/MOF





Relative concentrations of haemostatic factors and cytokines in solvent/detergent-treated and fresh-frozen plasma

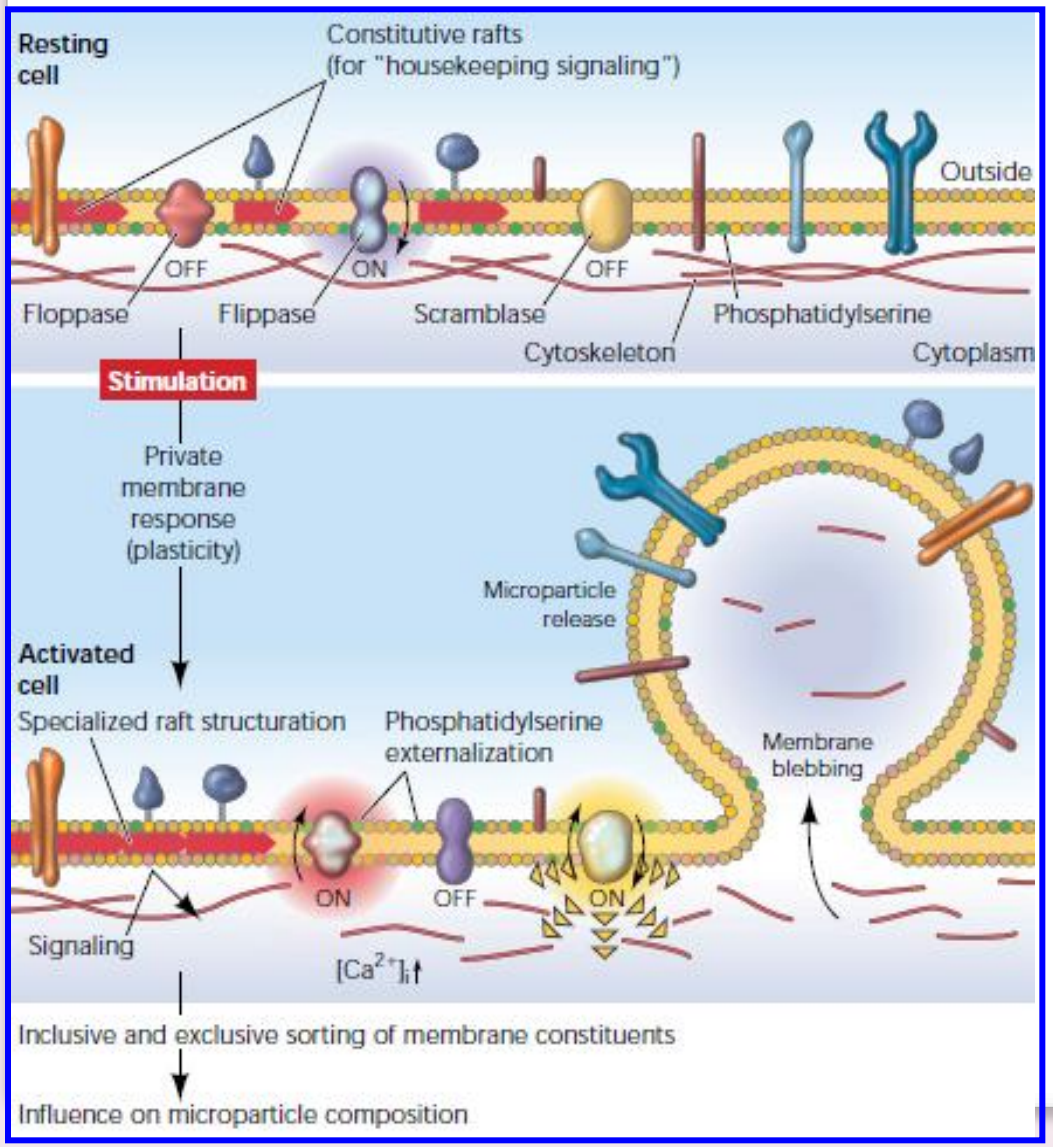


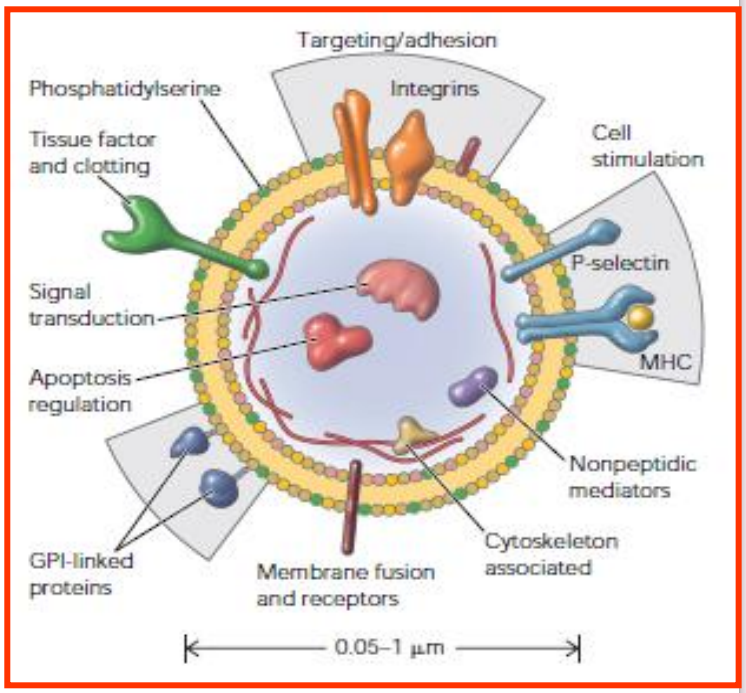
Blue=SDP

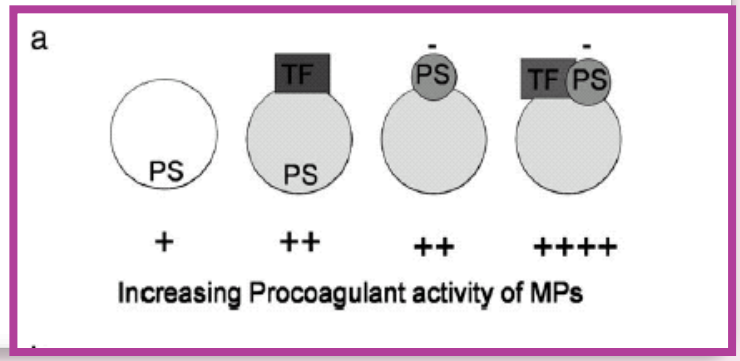
Green=FFP

British Journal of Anaesthesia **106** (4): 505–11 (2011)

CELLULAR MICROPARTICLES: A DISSEMINATED STORAGE POOL OF BIOACTIVE EFFECTORS







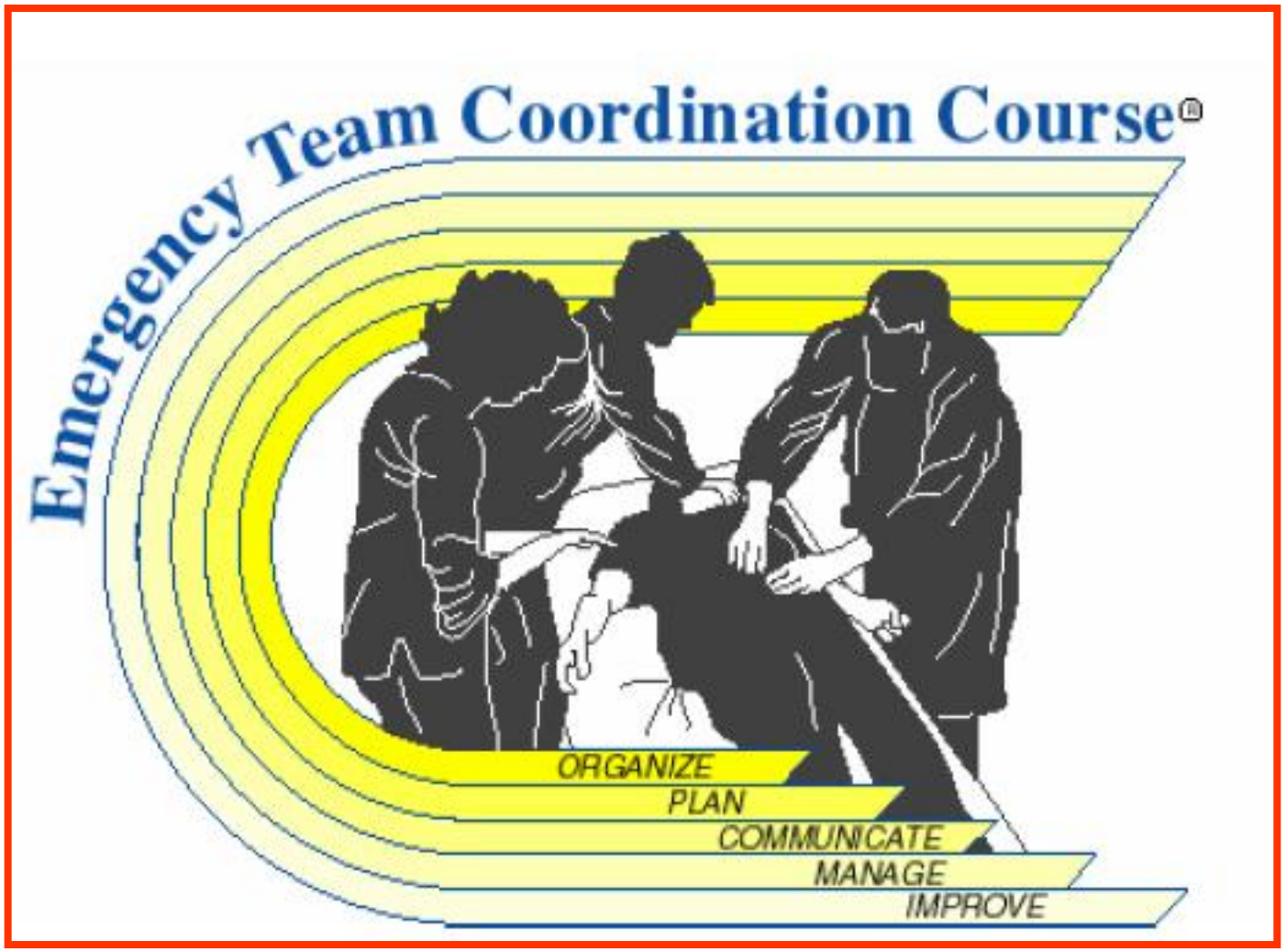
PROMMTT

Prospective, Observational, Multi-center Massive Transfusion sTudy

U.S. Department of Defense, Army Institute of Surgical Research, University of Texas Hhealth Science Center at Houston

10 leading trauma centers

Which protocols are associated with better survival


Emergency Team Coordination Course®
ORGANIZE
PLAN
COMMUNICATE
MANAGE
IMPROVE