



USE OF BLOOD AND BLOOD COMPONENTS IN PREHOSPITAL MEDICAL EMERGENCIES

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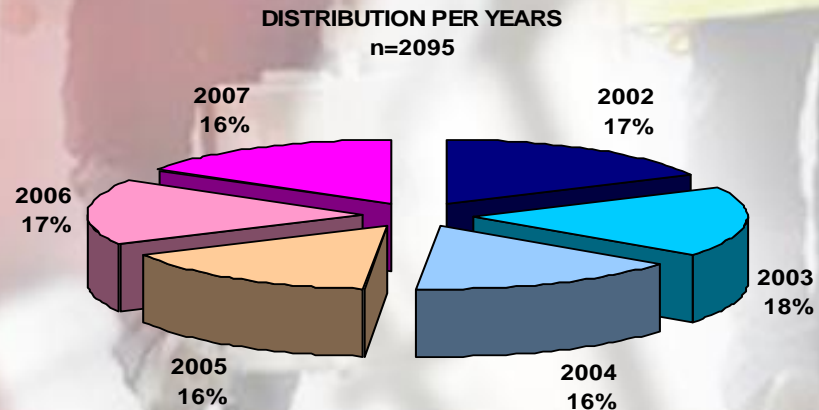




SAMUR- PC MADRID



- **Emergency Medical Service in the City of Madrid**
- **Emergency Care “in the street”, public facilities and Mass Casualty Incidents**
- **Over 600 professionals y 2000 volunteers**
- **Double-step (BLS and ALS)**
- **125.000 emergencies in a year**
- **2095 major trauma patients assisted (ISS>15) over the last 5 years (2002-2007).**



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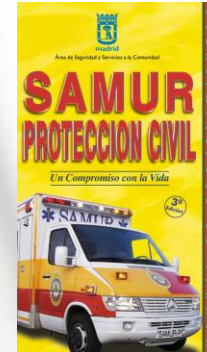




SAMUR PC. IS AN EMERGENCY MEDICAL SERVICE IMPLICATED IN THE MANAGEMENT OF THE MAJOR TRAUMA PATIENT



- Procedures for performance
- Own and specific education and training :
“Initial assistance to major trauma patient”.
- Handheld blood analyzer, IO access device, hemostatic dressings and bandages (HEMCON).
- ECO FAST.
- Code 15. Procedure for joint management to the major trauma patient with level 3 hospitals in Madrid



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HIPOVOLEMIC SHOCK



- **The early management of hypovolemic patients with major trauma represents one of the most important challenges to prehospital emergency medical services**
- **From Vietnam War to now, resuscitation of patients with traumatic shock has been performed under ATLS guidelines set up by the American College of Surgeons**
- **Research effort over the last years**
- **The management of patients with major trauma is still based on three pillars: control of external blood loss, correct hypovolemia and restore tissue perfusion.**



THE EUROPEAN EDUCATION INITIATIVE ON ADVANCED BLEEDING CARE (ABC-T)



Research

Open Access

Management of bleeding following major trauma: a European guideline

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EUROPEAN GUIDELINE



- **I. INITIAL RESUSCITATION AND PREVENTION OF FURTHER BLEEDING**
- **II. DIAGNOSIS AND MONITORING OF BLEEDING**
- **III. RAPID CONTROL OF BLEEDING**
- **IV. TISSUE OXYGENATION, TYPE OF FLUID, AND HYPOTHERMIA**
- **V. MANAGEMENT OF BLEEDING AND COAGULATION**



DIAGNOSIS AND MONITORING OF BLEEDING



RECOMMENDATION 2

We recommend that the extent of traumatic haemorrhage be clinically assessed using a grading system such as that established by the American College of Surgeons (ACS) (grad 1C)

Table 2

American College of Surgeons Advanced Trauma Life Support classification of haemorrhage severity

Haemorrhage severity according to ACS/ATLS classification ^a	Class I	Class II	Class III	Class IV
Blood loss (ml)	<750	750–1,500	1,500–2,000	>2,000
Pulse rate (per minute)	<100	>100	>120	>140
Blood pressure	Normal	Normal	Decreased	Decreased
Pulse pressure (mm Hg)	Normal	Decreased	Decreased	Decreased
Respiratory rate (per minute)	14–20	20–30	30–40	>40
Urine output (ml/hour)	>30	20–30	5–15	Negligible
Central nervous system (mental status)	Slightly anxious	Mildly anxious	Anxious, confused	Lethargic

^aValues are estimated for a 70-kg adult. Table reprinted with permission from the American College of Surgeons [26]. ACS/ATLS, American College of Surgeons/Advanced Trauma Life Support.

BJH 2006

Red cell transfusion is likely to be required when 30-40% blood volume is lost; over 40% volumen loss is immediatly life-threatening (American College of Surgeons, 1997)



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TISSUE OXYGENATION, TYPE OF FLUID, AND HYPOTHERMIA



RECOMENDATION 16:

We suggest a target systolic blood pressure of 80 to 100 mmHg until major bleeding has been stopped in the initial phase following trauma without brain injury (grade 2C).

“HIPOTENSIVE RESUSCITATION”

Aggressive fluid resuscitation may increase bleeding, lead to hemodilution, anemia and coagulopathy, remove clots due to an increase of the hydraulic pressure and make hypothermia worse



TISSUE OXYGENATION, TYPE OF FLUID, AND HYPOTHERMIA



RECOMMENDATION 17 : We suggest that crystalloids be applied initially to treat the bleeding trauma patient. Colloids may be added within the prescribed limits for each solution (grade 2C)

- **A recent meta-analysis showed no difference in mortality between colloids and crystalloids**

Roberts I, Alderson P, Bunn F, Chinnock P, Ker K, Schierhout G: **Colloids versus crystalloids for fluid resuscitation in critically ill patients.** *Cochrane Database Syst Rev* 2004, CD000567



TISSUE OXYGENATION, TYPE OF FLUID AND HYPOTHERMIA



“LOW VOLUME RESUSCITATION”

•HYPERTONIC SALINE (HS)

- ✓ First used in World War I. Regained importance in the 80's (Am J Physiol 1980; 239: H664)
- ✓ Used in patients with hypovolemic shock out of hospital, mainly in disasters and armed conflicts
- ✓ From 1999, the Committee on Fluid Resuscitation for Combat Casualties recommend the use of HS in the U.S. Army and NATO medical protocols



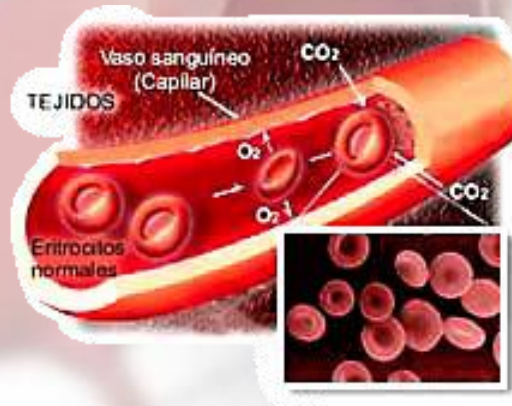
MANAGEMENT OF BLEEDING AND COAGULATION



RECOMMENDATION 19: We recommend a target Hb of 7 to 9 g/dl (grade 1C).

O₂ T (transportation) is kept with a Hb level of 5-7 gr/dl (guarantee a O₂ T of 500 ml/minute).

HCT 25-30% ensures an adequate O₂ Transport



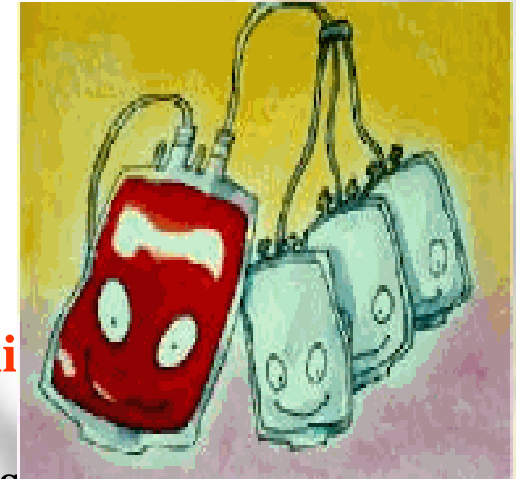


MANAGEMENT OF BLEEDING AND COAGULATION



INDICATIONS FOR BLOOD TRANSFUSION:

- With unknown Hb level:
 - Severe bleeding wound or injury
 - **Bleeding injuries causing hemodynamic instability after fluid replacement of 2000 ml**
 - Patients with bleeding injuries and cardiac arrest
 - Shock type III-IV.
- With known Hb level:
 - Trauma injuries, hypotension and Hb < 9g/dl without fluid replacement and Hb < 8 gr/dl after fluid replacement
 - Whenever Hb < 7 gr/dl





USE OF BLOOD AND BLOOD COMPONENTS IN PRE-HOSPITAL EMERGENCIES



- **Blood and blood components transfusion is still an important key part of XXI century medicine**
- **A great effort to ensure their safety has been done**
- **There are potential risks that can be minimized if the management follows strict protocols**
- **Precise THERAPEUTIC INDICATION evaluating the risk-benefit ratio**
- **Use of the suitable blood product for each situation.**
- **Is a temporary therapeutic measure**
- **Advantages: carry oxygen, improve hematic parameters and provide coagulation factors**



USE OF BLOOD AND BLOOD COMPONENTS IN PREHOSPITAL MEDICAL EMERGENCIES

INDICATIONS



BLOOD COMPONENTS TRANSFUSION IS INDICATED IN PATIENTS WHOSE HEMODYNAMIC CONDITION DO NOT IMPROVE AFTER THE INFUSION OF 2000 ML OF CRYSTALLOIDS/COLLOIDS AND WHENEVER THE INITIAL BLOOD LOSS WAS GREATER THAN 40%



USE OF BLOOD AND BLOOD COMPONENTS IN PRE-HOSPITAL EMERGENCIES CHOOSING THE RIGHT BLOOD COMPONENT



FRESH WHOLE BLOOD (WFB): unusual in civilian practice

In combat settings the “walking blood bank” is described

RED BLOOD CELLS CONCENTRATE (RBCC)

- **1 unit (300 ml) increase Hb 1gr/dl and a 3% Hct**
- **2-4 units O+ or O-. Uncross-matched (15) or Cross-matched (45)**



USE OF BLOOD AND BLOOD COMPONENTS IN PRE-HOSPITAL EMERGENCIES

CHOOSING THE RIGHT BLOOD COMPONENT



PLATELETS: Ensure a platelet count $> 50,000/\text{ul}$. Platelet hypofunction is found after transfusion. A normal PLT count do not exclude bleeding. In an empirical way, 2 units of platelets should be given by each 4-6 RBCC.

FRESH FROZEN PLASMA (FFP): Provide all the coagulation factors. Dose: 10-20 ml/Kg. In massive transfusion, 2 units of FFP should be given by each 4-6 RBCC.

CRYOPRECIPITATE (CRYO): Provide high dose of factor V, VIII and Fibrinogen. Indicated in patients with significant hypofibrinogenemia



USE OF BLOOD AND BLOOD COMPONENTS IN PREHOSPITAL MEDICAL EMERGENCIES. PROBLEMS



- Legal problems.
- Logistic problems (maintenance of the blood cold chain, blood transportation in the best conditions)
- Adverse effects related to the infusion rate. “Blood Bank Injury”
- Blood infusion devices: Infusion pumps, blood warming devices, filter systems...
- Cost, expiration date
- Few patients candidate for transfusion. Cost-opportunity



USE OF BLOOD AND BLOOD COMPONENTS IN PREHOSPITAL MEDICAL EMERGENCIES. LEGAL PROBLEMS



Royal Decree 1088/2005. Technical requirements and minimum conditions of the blood donation and of the transfusion centers and services (Chap.VI.Art.28)

**THE USE OF BLOOD AND BLOOD COMPONENTS OUT OF
THE HOSPITAL IS NOT PERMITTED BY SPANISH LAW AT
THE PRESENT TIME**

Main handicap: Impossibility of ensure the TRACEABILITY required by law



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USE OF BLOOD AND BLOOD COMPONENTS IN PREHOSPITAL MEDICAL EMERGENCIES. LOGISTIC PROBLEMS



	RBCC 200-300 ml	FFP 200-300 ml	PLATELETS 200-300 ml
Blood bank storage temperature	4°C	< -30°C	22°C with shaking
Preservation if the transfusion is delayed	4°C	4°C Up to 24h	22°C Up to 4 h without shaking
Top exposition time to a uncontrolled temperature by blood bank	4H	4H	4H



ADVERSE EFFECTS RELATED TO THE INFUSION RATE



- **Blood is preserved with citrate that chelates calcium ions in the blood. If the infusion rate is higher than 15min/unit, calcium chelation will not be significant**
- **Stored blood can have high extracellular potassium levels . One unit can have more than 30 mEq/L. An infusion rate higher than 100 ml/min may produce arrhythmias in the patient**
- **In emergency situations the infusion rate can be as rapid as needed**



USE OF BLOOD AND BLOOD COMPONENTS IN PREHOSPITAL MEDICAL EMERGENCIES. INFUSION DEVICES



- **PRESSURE INFUSION PUMP** . Portable (with battery)
- **WARMERS**. warming to 42°C is permitted by FDA (no hemolysis or osmotic fragility)
 - **DRY** warmers: **Hemocare**, Ranger, MediTemp, Warmflo.
 - Counter-clockwise water circulation warmer: **Hotline**, Termiflo.
 - Magnetic induction warmer: FMS 2000.
 - In-line microwave warmer : Themostat



USE OF BLOOD AND BLOOD COMPONENTS IN PREHOSPITAL MEDICAL EMERGENCIES. CONTROVERSY



- **IMPORTANT BENEFITS OF HEMOTHERAPY**
- **EFFICIENT AND NON-EXPENSIVE VOLUME EXPANDING SOLUTIONS EASY TO STORE AND EASY TO USE**
- **FORMER STUDIES SHOW VIABLE TRAUMA PATIENTS WITH HB LEVEL OF 2G/DL**
- **FEW PATIENTS CANDIDATE FOR TRANSFUSION**



CONCLUSIONS



- **PROVIDES A SIGNIFICANT IMPROVEMENT IN THE MANAGEMENT OF THE PATIENT WITH MAJOR TRAUMA**
- **THE USE OF BLOOD AND BLOOD COMPONENTS IN OUT-OF-HOSPITAL MEDICAL EMERGENCIES IS TEMPTING**
- **IT IS A DIFFICULT PROJECT**
- **LITTLE EXPERIENCE WORLDWIDE**



THANK YOU

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