

Critical bleeding – the Finnish experience

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”...have we become much better?”

Critical bleeding - definition

**Continuing need for pressure driven
intravenous fluid and blood component
replacement**

Compensatory mechanisms fail

\geq 50 units red blood cells

**Massive blood transfusion exceeding
50 units of plasma poor red cells or
whole blood: the survival rate and the
occurrence of leukopenia and acidosis**

Hakala P *et al.* Injury 1999; 30: 619-622

- **Study period of six years: 1992-1997**
- **During one or two days**
- **Trauma victims, one malignancy**

- **Mean age: 41 years**
- **Range: 17-79 years**
- **Males: 19**
- **Females: 4**

Survival to discharge

- **23 patients**
- **Survival: 16 patients**
 - **three of five who received over 100 units**
- **Oldest who survived was 79-year-old**

Deaths

- **Three of seven on the day of trauma**
- **Causes of death:**
 - **severe brain injury**
 - **bleeding**
 - **ARDS**
 - **MODS**

Lowest values associated with survival

Hb (g/L)	16
platelet count ($\times 10^9/L$)	11
pH	6.87

The initial pH

- In the survivors: 7.07 – 7.46
- In the nonsurvivors: 7.09 – 7.34

➤ **All had leukopenia**

Extreme

**Massive transfusion exceeding 150 units
of packed red cells during the first 15 h
after the accident: case report**

Hakala *et al.* J Trauma 1998; 44: 410-412

Time	B-Hb (g/dL)	Hkr (%)	Tromb (10 ⁹ /L)	pH	BE (mmol/L)	P _{CO₂} (kPa)	P-K (mmol/L)
9:10 AM	6.8	20	158				
9:35 AM	1.6	5	51	7.20	-11.8	5.1	
10:10 AM	5.4	16	11	7.14	-20.0	3.1	4.3
11:05 AM	4.1	12	58	7.25	-14.1	3.7	4.1
0:10 PM	8.3	25	34	7.06	-16.2	6.4	4.3
1:15 PM	4.4	13	64	7.28	-6.2	5.6	4.8
2:05 PM	8.1	26	28	7.27	-7.4	5.6	4.2
3:05 PM	9.5	29	52	7.35	-5.8	4.6	4.5
4:25 PM	11.3	34	104	7.39	-4.0	4.4	3.7
5:15 PM	11.8	35	139	7.39	-2.4	4.8	
7:15 PM	13.1	40	155	7.44	0.5	4.7	2.7
9:00 PM	13.2	39	172	7.47	2.2	4.6	
11:15 PM	15.0	45	142	7.47	0.0	4.2	2.7

B-Hb, blood hemoglobin; Hkr, hematocrit; Tromb, thrombocytes; BE, base excess; P_{CO₂}, partial pressure of carbon dioxide in arterial blood; P-K, plasma potassium.

Ten years after

- **Study period of six years 2001-2006**
- **50 or more units of red blood cells during one or two days**

Survival to discharge

- **27 patients**
- **Survival: 14 patients**
- **Two patients received over 100 units
- both survived**

Survivors

- **M / F – 10 / 4**
- **Age range: 16 - 57 years**
mean 34 years

- **> 100 Units (102, 105) two patients**
- **pH < 7.00 two patients (6.89, 6.90)**
- **Lowest**
 - Hb **43 (g/L)**
 - platelet count **11 ($\times 10^9/L$)**
- **Leukopenia 12 / 14**

Non-survivors

- **M / F – 11 / 2**
- **Age range: 17 – 66 years**
mean 36 years

➤ **pH \leq 7.00 four patients
(6.80, 6.81, 6.82, 7.00)**

➤ **Lowest**

- Hb

40 (g/L)

- platelet count

3 ($\times 10^9/L$)

➤ **Leukopenia 13 / 13**

Deaths

- **Seven on the day of trauma**
 - **five had severe head injury**

- **Causes of death:**
 - **severe brain injury**
 - **bleeding**
 - **MODS**

Conclusions

- **Patients with critical bleeding are worth treating**
- **Severe brain injury is the worst threat inside hospital, not massive bleeding**

