Ratio-based Transfusion Management

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목차

1. Ratio-based transfusion

Ratio-based Transfusion

Review > J Clin Med. 2021 Jan 17;10(2):320. doi: 10.3390/jcm10020320.

Whole Blood, Fixed Ratio, or Goal-Directed Blood Component Therapy for the Initial Resuscitation of Severely Hemorrhaging Trauma Patients: A Narrative Review

Whole blood

Fixed ratio

Goal-directed blood component therapy

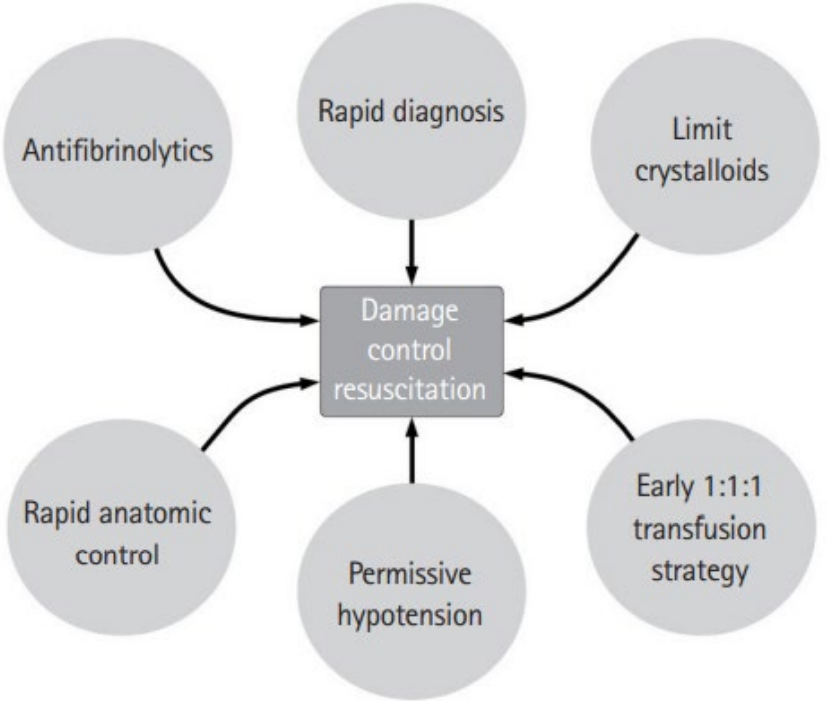
Ratio-based Transfusion

Damage Control Resuscitation (DCR)

Surgical control of bleeding and resuscitation must happen simultaneously

Limit secondary blood loss

Prevent coagulopathy



Clin Exp Emerg Med. 2020 Mar; 7(1): 5–13.
Published online 2020 Mar 31. doi: 10.15441/ceem.19.089

Damage control resuscitation

Ratio-based Transfusion

Clinical experience in Operation Iraqi Freedom and Operation Enduring Freedom: In combat casualties requiring major resuscitation (10–40 units of blood products)

- Minimizing crystalloid
  - 5-8 L of crystalloid during the first 24 hours
  - 50% of standard resuscitation practice
- Thawed plasma as a resuscitation fluid

- Less coagulopathic bleeding
- Warm, euvolemic and non-acidotic, with a normal INR and minimal edema in ICU
- More quickly extubated

› J Trauma. 2007 Feb;62(2):307-10. doi: 10.1097/TA.0b013e3180324124.

Damage control resuscitation: directly addressing the early coagulopathy of trauma

Ratio-based Transfusion

Classically, traumatic coagulopathy is thought to be due to the consumption of coagulation factors and dilution from intravenous blood and fluid therapy.

Coagulopathy may be present at the time of admission

- Before significant resuscitative fluid has been given (not d/t dilution)
- Acidosis-induced coagulation factor dysfunction
- Coagulation factor consumption
- Hypothermia-induced failure of platelet activation
- Hypoperfusion induce early traumatic coagulopathy

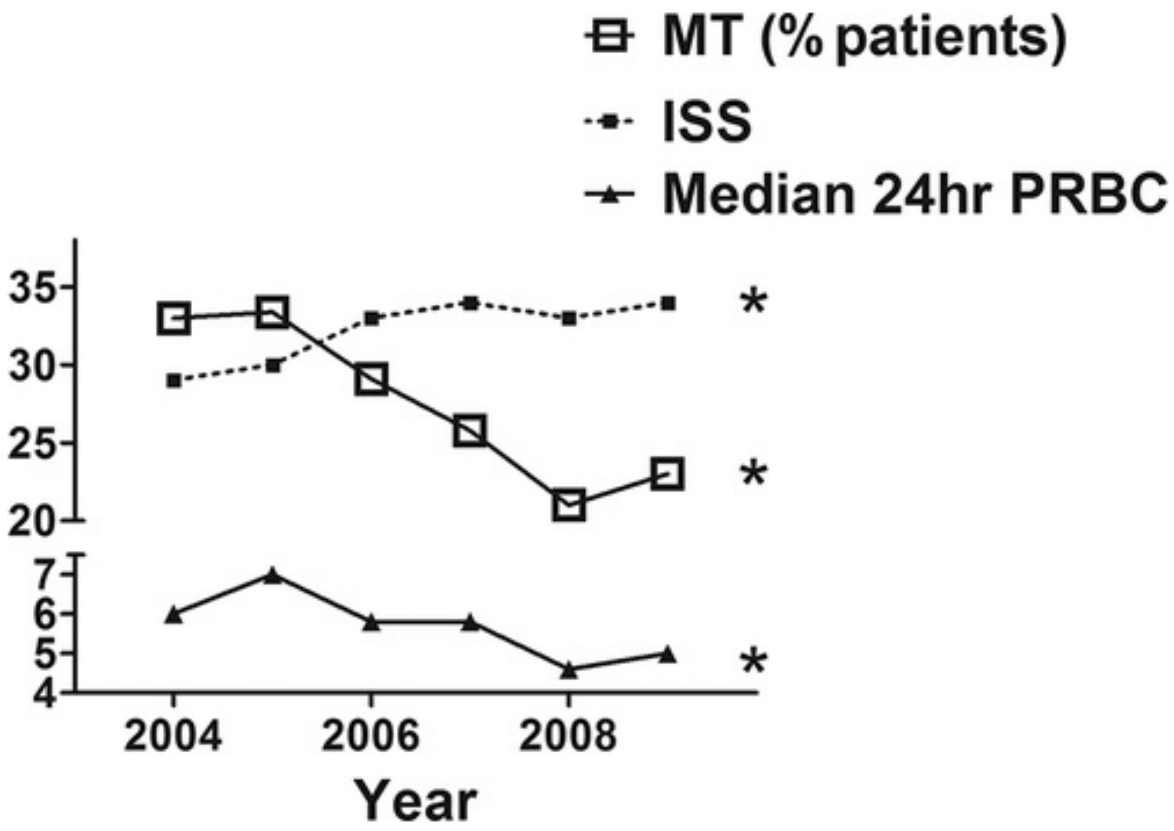
› Ann Surg. 2007 May;245(5):812-8. doi: 10.1097/01.sla.0000256862.79374.31.

Acute traumatic coagulopathy: initiated by hypoperfusion: modulated through the protein C pathway?

Ratio-based Transfusion

Multicenter Study > J Trauma Acute Care Surg. 2012 Jan;72(1):106-11.
doi: 10.1097/TA.0b013e3182410a3c.

Changes in massive transfusion over time: an early shift in the right direction?



Ratio-based Transfusion

Earlier, more aggressive attainment of high transfusion ratios
→ May shift overall blood requirements below those which currently define massive transfusion

Definition of massive transfusion: ≥ 10 units of pRBC in 24 hours

Sub-MT group (7≤ units of RBC <10) during recent time period
- Significantly higher transfusion ratios
- Greater percent of 6-hour/24-hour FFP and PLT

Ratio-based Transfusion

Comparative Study > JAMA Surg. 2013 Feb;148(2):127-36. doi: 10.1001/2013.jamasurg.387.

The prospective, observational, multicenter, major trauma transfusion (PROMMTT) study: comparative effectiveness of a time–varying treatment with competing risks

Higher plasma:pRBC and platelet:pRBC ratios
→ survival benefits in the first 6 hours

Patients with below 1:2 were 3 to 4 times more likely to die than patients with ratios greater than 1:1

Ratio-based Transfusion

Clinical Trial > JAMA. 2015 Feb 3;313(5):471-82. doi: 10.1001/jama.2015.12.

Transfusion of plasma, platelets, and red blood cells in a 1:1:1 vs a 1:1:2 ratio and mortality in patients with severe trauma: the PROPPR randomized clinical trial

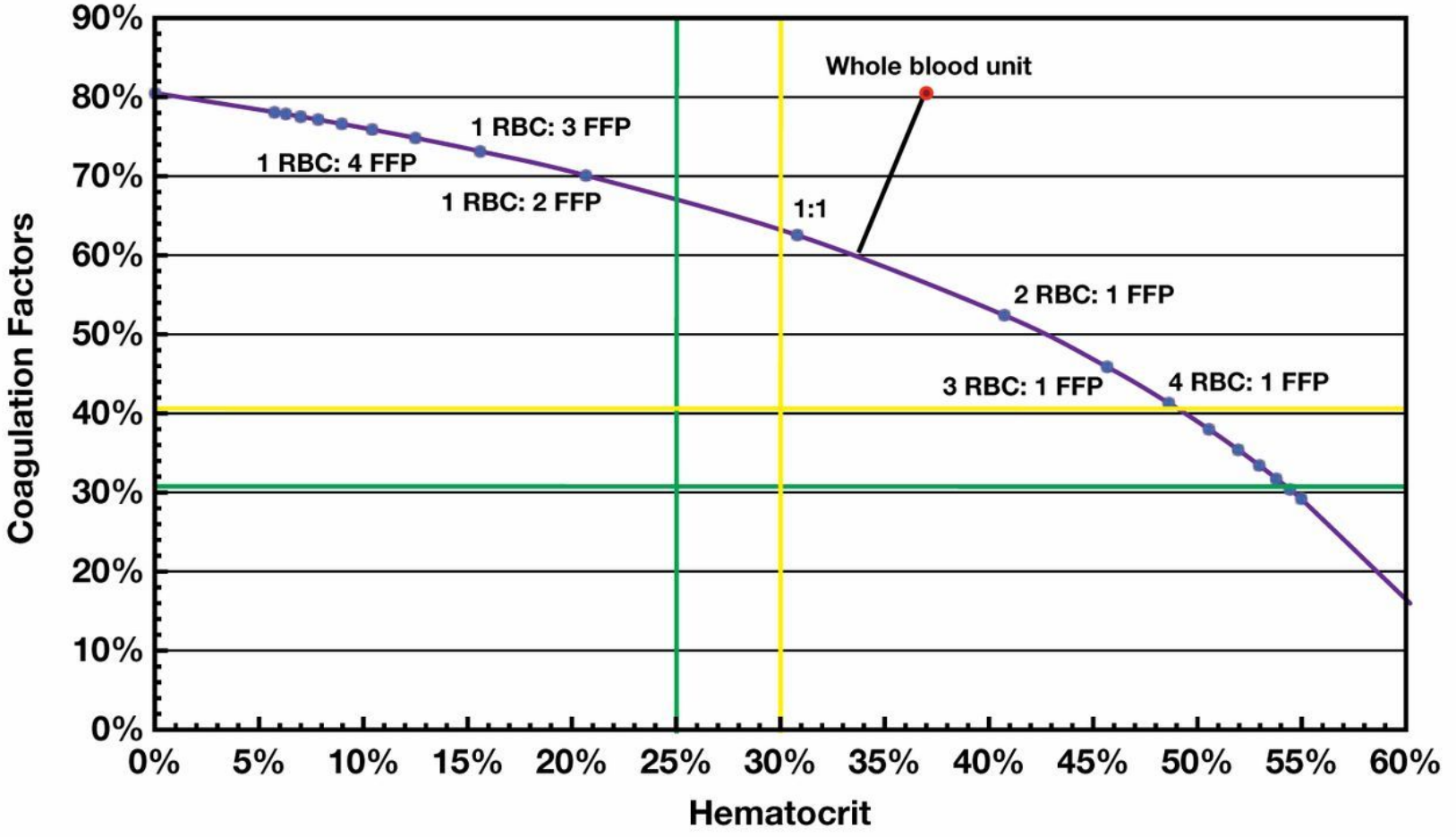
Large, multicenter, randomized control trial
Plasma:platelet:pRBC ratio 1:1:1 vs 1:1:2

No significant difference in mortality at 24 hours to 30 days

In 1:1:1 group

- Increase in early hemostasis
- Decreased in deaths due to bleeding during first 24 hours
- No increase in transfusion-related complications

Ratio-based Transfusion

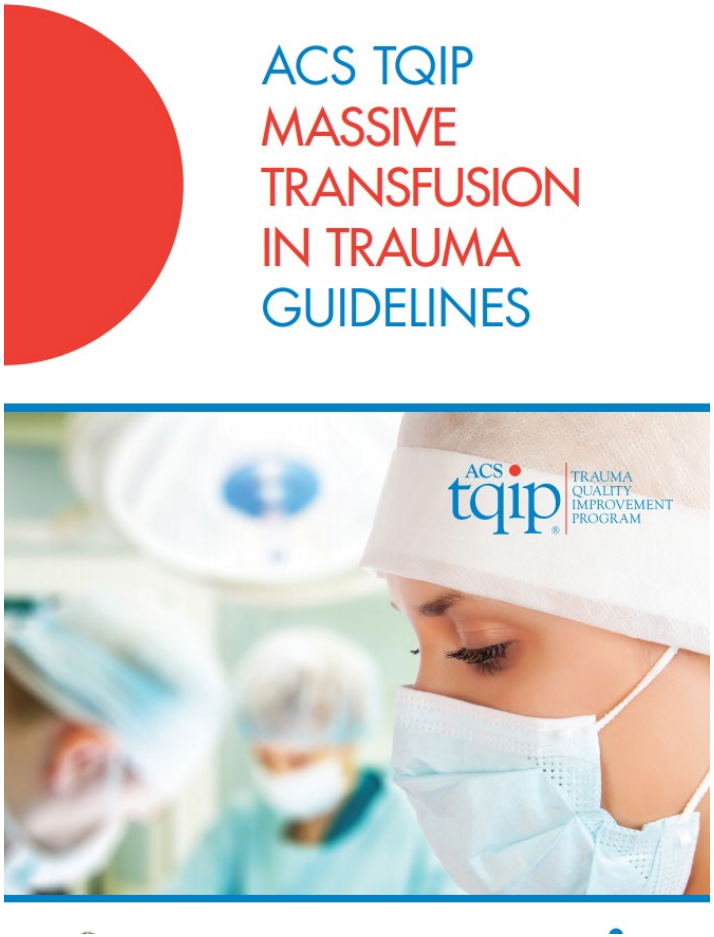


Lab Med. Spring 2015;46(2):e46-52. doi: 10.1309/LMJQNOQCFG4GKQRJ.

2. Massive Transfusion Protocol (MTP)

Massive Transfusion Protocol (MTP)

Trauma centers of all levels must have a massive transfusion protocol (MTP).



Massive Transfusion Protocol (MTP)

Development of MTP

Written document
All staff should be familiar with the protocol
Especially important in **smaller trauma centers** where MTP initiations are rare

Based on Damage control resuscitation
- Ratio based blood products
- Immediate availability of RBC, plasma, and platelets

Should be developed by multidisciplinary committee
- Blood bank, emergency department, anesthesia, trauma service
- 정보관리팀..

Ajou Trauma Center Massive Transfusion Protocol

MTP Leader

- Trauma leader/마취과 당직
- **수술장 이동 시 마취과 당직 staff 에게(010-3064-0274) MTP 상황 인계**

MTP Guardian

- T-bay/OR/ICU-nurses.
- MTP pack 의뢰/수령/투여.
- **Leader가 지시한 RBC 투여 개수에 따라 FFP 자동 의뢰**

MTP runner

- 간호 보조원, TS전담간호사
- 수혈의뢰서/sample/MTP각서 접수,혈액 수령 및 전달
- **MTP feedback**

Blood Bank : ☎ 5775
T-bay : ☎ 7565
Anes. Staff(Duty) :
(010-3064-0274)/ #86699
Anes. Nurse : ☎ 7528
Trauma staff(Duty) :
(010-2901-7763)/ #87733

2021.6.22
Ajou University Hospital
Trauma Center
Quality Improvement Team

ABO sampling

Vascular Access (상지 18G 이상 x 2, 필요시 MAC cath.)

ACTIVATION : MTP button + FMS setting

Universal donor MTP pack
0/2/4 (RBC + FFP)

Type-matched MTP pack
4 RBC + 4 FFP

Definitive Hemostasis ?

NO

YES

TERMINATION : MTP 종료 처방

MTP 종료 이후 수혈 계획 고지

At ICU

- POCT BGA Electro Lactic, Hb q1hr
- Hgb, Hct, Plt , Ca^{2+} q3hr
- TEG q6hr

Adjuvant

- If < 8hr Tranexamic acid
- MTP 2pack 주입마다 Plt con. 6 u 3g Ca glc.

MTP Indication

- ❖ **HEMODYNAMIC INSTABILITY and**
- ❖ **EVIDENCE of ACTIVE BLEEDING**
  - ✓ **THORAX / ABDOMEN / PELVIS / EXTERNAL**
- ❖ **ABC score ≥ 2**
  - ✓ **SBP ≤ 90**
  - ✓ **HR ≥ 120**
  - ✓ **positive FAST**
  - ✓ **Penetrating injury in torso**

TEG

- If @ angle < 63° : Cryo. 10 units
- If LY 30 ≥ 3% : TXA 1 g IV

Coag. lab

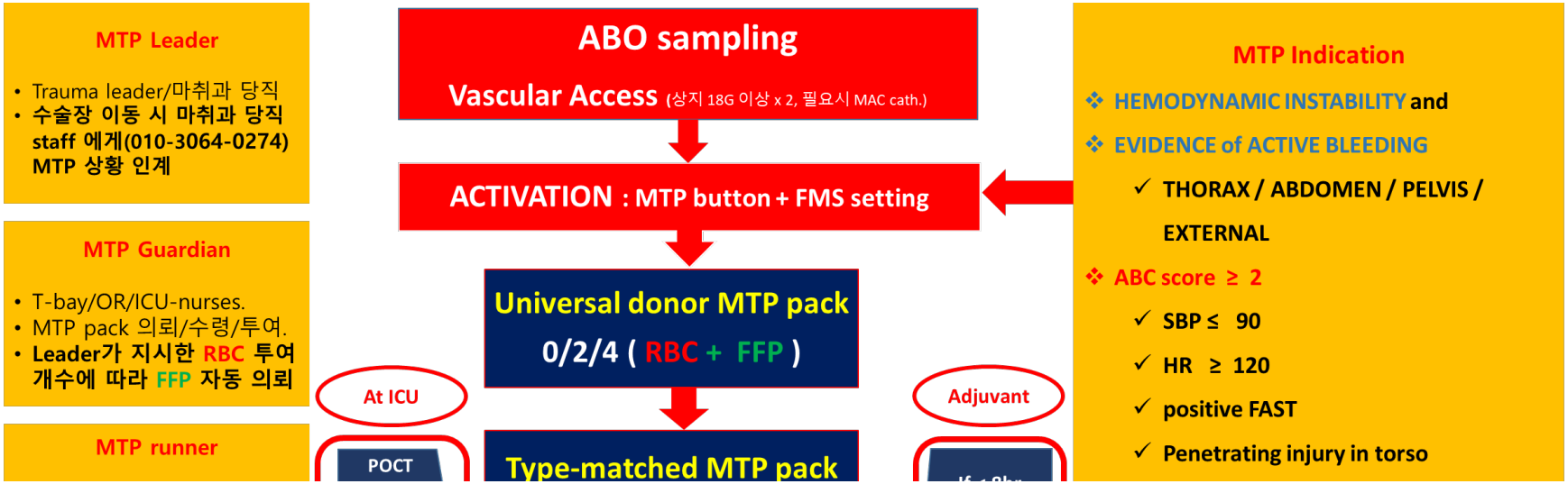
- If INR ≥1.7 or aPTT ≥63 : 4 FFP
- If fibrinogen < 100mg/dL : 10 Cryo.
- If PLT < 75 $x10^9$/L or anti-PLT meds: Plt conc. or apheresis
- If TBI : PLT Goal > 100 $x10^9$/L
- If i Ca^{2+}< 4mg/dL : 3g Ca glc.

Permissive Hypotension

- Before definitive hemostasis
  - ✓ Target BP: Sys BP <100
  - ✓ mean BP > 60
  - ✓ 제한적인 승압제 사용
  - ✓ TBI or over 65 는 금기

Massive Transfusion Protocol (MTP)

Activation of MTP



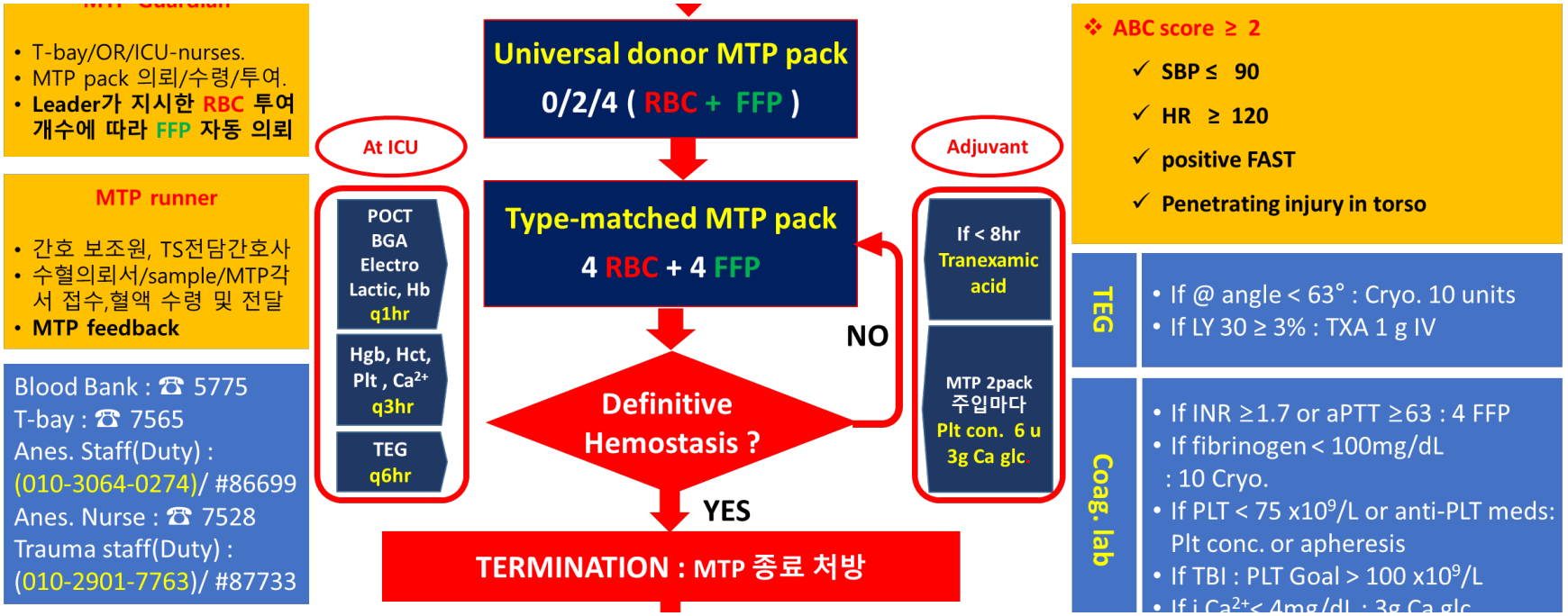
Massive Transfusion Protocol

Universal O+ RBC 2~4 units

Immediately available in T-bay

ABO sampling should be done before O+ RBC transfusion

Massive Transfusion Protocol



Communication is the most important!

Blood product delivery should continue to the site of patient care

- T-bay, operating room, angiography suite, ICU…

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Massive Transfusion Protocol

Use a rapid transfuser with warmer

To prevent hypothermia

Massive Transfusion Protocol

Endpoint of Massive Transfusion Protocol

Decision should by made by the trauma surgeon in conjunction with the anesthesiologists

Anatomical criteria: Control of Bleeding
Physiologic criteria: Normalizing hemodynamic status

Ratio-based Transfusion → Goal-directed Transfusion

Massive Transfusion Protocol

Plasma Thawer

Massive Transfusion Protocol

상황구별	수혈 전 검사 단계	혈액제제*	비고
일반	-ABO/RhD 혈액형 검사 -비예기항체 검사 -교차시험(1,2,3단계)	Group matched, Crossmatched	비예기항체 검사 음성 시 1단계 교차시험도 가능
아응급 (Urgency)	-ABO/RhD 혈액형 검사 -교차시험(1단계)	Group matched, Crossmatched	환자 검체 채혈한 경우
응급 (Emergency)	-ABO/RhD 혈액형 검사	Group matched, Uncrossmatched	환자 검체 채혈한 경우
초응급 (Immediate resuscitation)	-모두 생략	Universal O type RBCs, Uncrossmatched	환자 검체 채혈 불가능한 경우
응급 /대량수혈	-모두 생략	Universal O type RBCs/ AB type FFP/ AB type Platelets, Uncrossmatched universal	환자 검체 채혈 불가능한 경우, MTP** 적용시

보건복지부
질병관리본부

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Massive Transfusion Protocol

Monitoring system performance in massive transfusion

Review cases of massive transfusion with the following complications

- Coagulopathy
- Thrombotic complications
- ARDS
- Other transfusion reactions
  - TACO (transfusion-associated volume overload)
  - TRALI (transfusion-related acute lung injury)
  - Hemolytic transfusion reaction
- Over-transfusion of RBC
- Death

Massive Transfusion Protocol (MTP)

Journal of Trauma and Injury 2020; 33(2): 74-80.
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Effects of Massive Transfusion Protocol Implementation in Trauma Patients at a Level I Trauma Center

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Before MTP implementation vs After MTP implementation

No significant difference in the clinical outcomes
Rapid and balanced transfusion after MTP implementation

감사합니다.

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