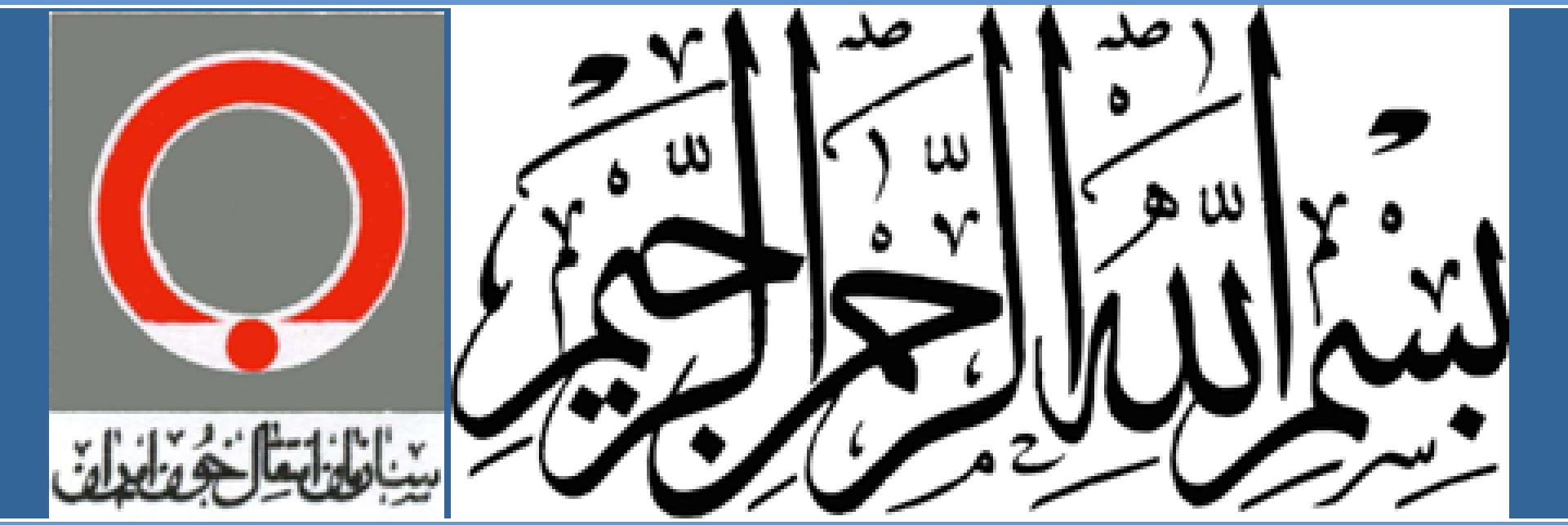

بسم الله الرحمن الرحيم

Hemotherapy Decisions & Their Outcomes

ABO group selection for RBC Transfusion

Recipient ABO Group		Component	ABO Group	
	1st Choice	2nd Choice	3rd Choice	4thChoice
A	A	O	None	None
B	B	O	None	None
AB	AB	A	B	O
O	O	None	None	None
Oh (Bombay Group)	Oh	None	None	None

O group selection for Plasma/FFP Transfusion

Recipient ABO		Component	ABO	
	1st Choice	2nd Choice	3rd Choice	4thChoice
A	A	AB	None	None
B	B	AB	None	None
AB	AB	None	None	None
O	O	AB	A	B

ABO group selection for Platelet Transfusion

Recipient ABO		Component ABO		
	1st Choice	2nd Choice	3rd Choice	4thChoice
A	A	AB	B	O
B	B	AB	A	O
AB	AB	A	B	O
O	O	A	B	AB

TABLE 19-3. ABO Matching

Recipient ABO Type	ABO-Compatible RBC Units	ABO-Compatible Plasma or Platelet Units
O	O	A, B, O, AB
A	A, O	A, AB
B	B, O	B, AB
AB	A, B, O, AB	AB

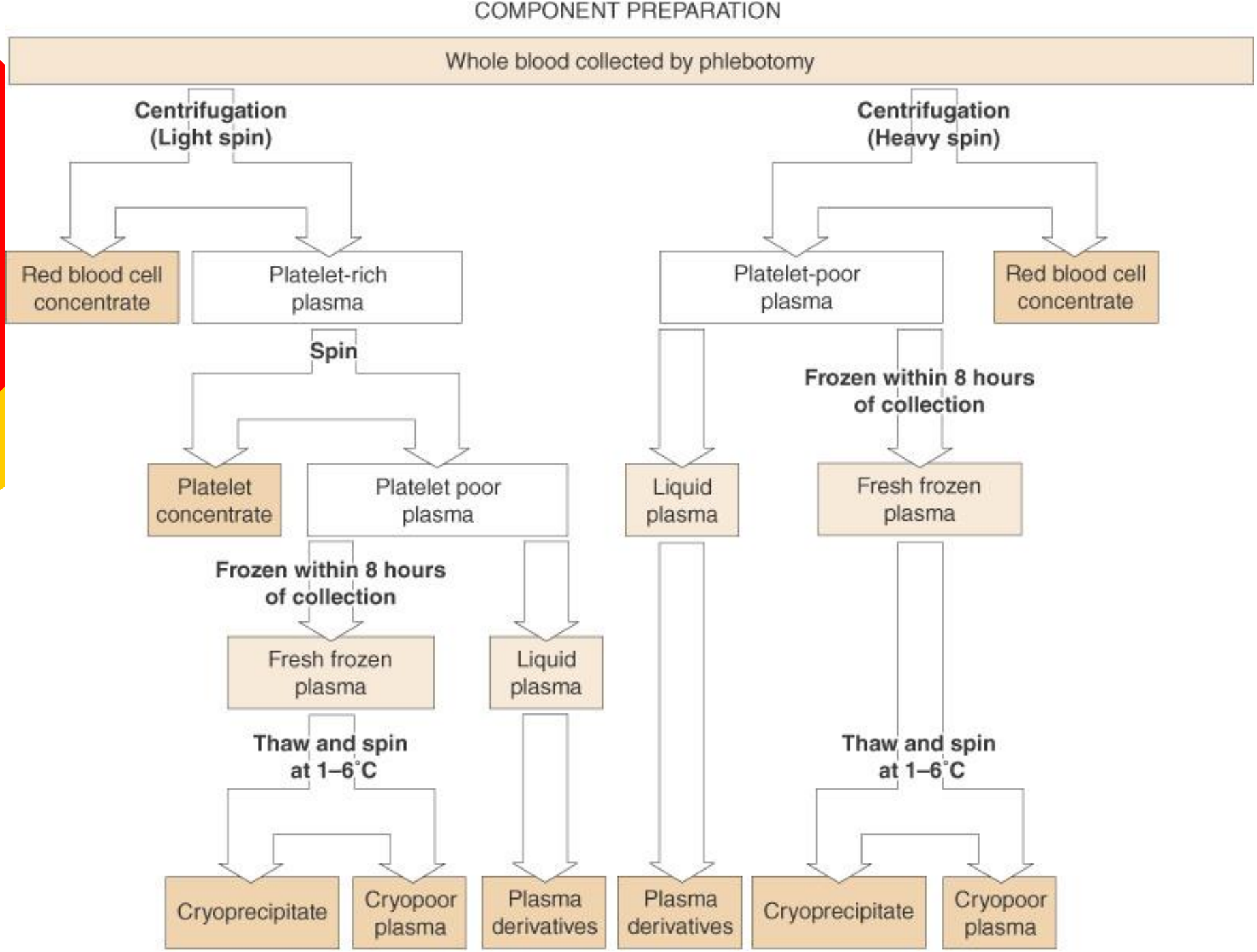
RBC = Red Blood Cell.

وظایف سازمان انتقال خون

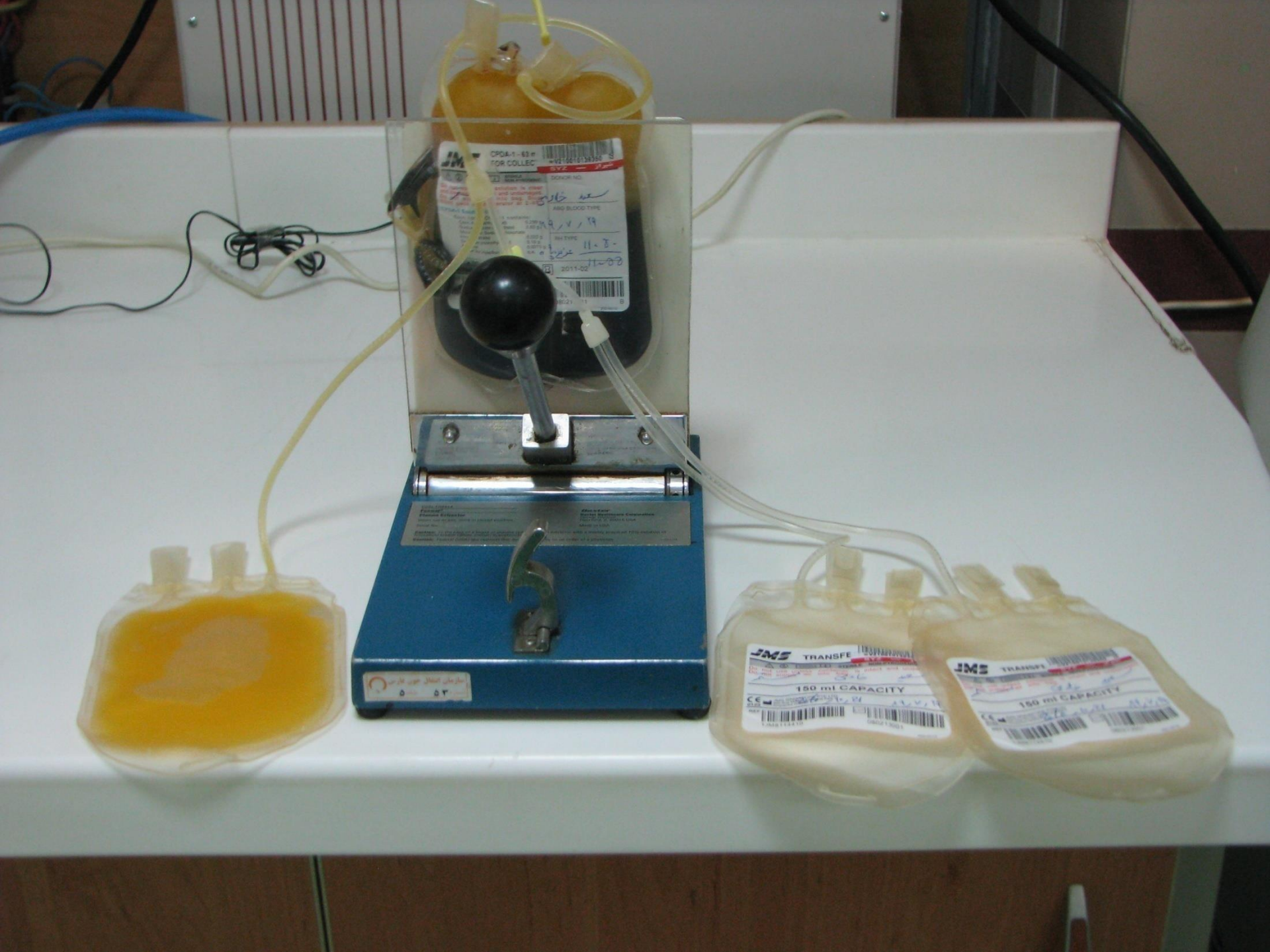
1. انتخاب اهدا کننده سالم
2. آزمایشات لازم بر روی خون های اهدایی (بررسی HIV و HBV و HCV و سیفلیس و تعیین گروه خون)
3. تهیه فرآورده های مختلف نظیر گلبول قرمز، پلاکت، پلاسما، کرایو و سایر فرآورده ها نظیر گلبول قرمز شسته شده یا اشعه دیده و...
4. نگهداری صحیح فرآورده های خونی
5. ریلیز و پخش خون

- يك واحد خون كامل پس از طي مراحل مختلف سانتريفيوژ مي تواند به واحدهاي: گلبول قرمز متراكم (Packed cell; PC)،پلاكتRDP ،پلاسماي تازه منجمد(FFP) وكرايو پرسيپيتات (Cryoprecipitate) تبديل گردد(Cellular & Acellular products) .
- از پلاسماي به دست آمده در بخشهاي پالايش ميتوان محصولات پلاسماي مختلفي از قبيل آلبومين، ايمونوگلوبولينها، فاكتورهاي انعقادي و آنتي سرم هاي مختلف تهيه نمود.
- فرآورده هاي خون آن دسته از مواد تشكيل دهنده خون هستند كه كاربرد درماني داشته، مي توانند بوسيله سانتريفيوژ ، فيلتر كردن و منجمد نمودن با استفاده از روش هاي مرسوم انتقال خون تهيه گردند.

AABB TECHNICAL MANUAL chapter6 PAGE:189-225




JMS
TRANSFER
150 ml CAPACITY
JMS SINGAPORE PTE LTD
1JM8114410
JMS
TRANSFER
150 ml CAP
JMS SINGAPORE PTE LTD
1JM8114410
JMS
CPDA-1 - 63 m
FOR COLLECT
Do not use unless solution is clear and container is intact and undamaged. Do not supply air into bag. Store filled pack in refrigerator at 2-6°C.
CPDA-1 Solution U.S.P.
Each 100ml CPDA-1 contains:
Citric Acid (anhydrous) 0.299 g
Sodium Citrate (dihydrate) 2.63 g
Monobasic Sodium Phosphate (monohydrate) 0.222 g
Dextrose (monohydrate) 3.19 g
Adenine 0.0275 g
Water for injection q.s.
DONOR NO.
ABO BLOOD TYPE
RH TYPE
JMS SINGAPORE PTE LTD
2011-02
1JM8114410


CPDA-1 - 63 ml
FOR COLLEC
DONOR NO.
ABO BLOOD TYPE
RH TYPE
2011-02
JMS
TRANSFE
150 ml CAPACITY
JMS
TRANSFE
150 ml CAPACITY


A
C
D
EX4
JMS
150 ml CAPACITY

Red cell Transfusion

AABB:

50-60% in surgery

30% ICU

Majority of transfusion decision in "acute settings "

FBTO:

30% for thalassemia major & intermediate

40% for cardiac surgery

10-15% for organ transplantation

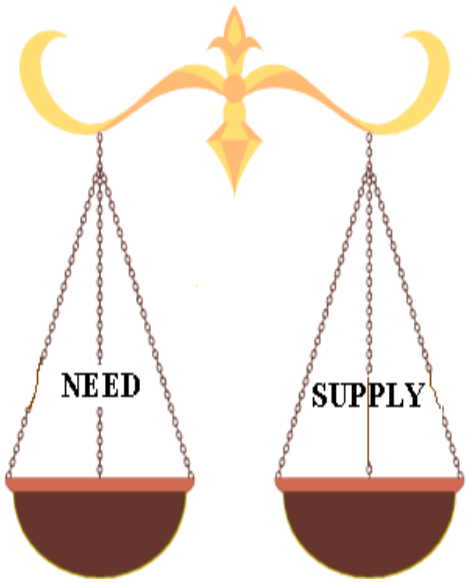
15-20% for General surgery & medicine

Blood is the most dangerous medication that a physician ever prescribes”

When Deciding to Transfuse

REMEMBER…

THE DECISION FOR BLOOD TRANSFUSION SHOULD ALWAYS BE A BALANCE BETWEEN



Storage temperatures

- خون در یخچال 1-6 : 35-42 روز
- پلاکت در دماي اتاق 20-24: 3-5 روز
- کرایو و پلاسما در فریزر -18 درجه:12months
- کرایو و پلاسما در فریزر -25 درجه: 2 years
- کرایو و پلاسما در فریزر >-25 درجه: 36 months
- پلاسماي آب شده در یخچال 1-6 : 24 ساعت
- کرایو آب شده در دماي اتاق: 4 ساعت

خون كامل (Whole blood)

- يك واحد خون كامل شامل 450 سي سي خون(به طور متوسط) و 63 ميلي ليتر ماده ضد انعقاد – نگهدارنده است .
- Whole bloodهماتوكريت آن 36 تا 44 درصد است .
- مدت نگهداري 35 روز(با ضد انعقاد CPDA-1) و21 روز با (باضدانعقاد CPD) مي باشد دماي نگهداري خون كامل و خون فشرده 1-6 درجه سانتي گراد مي باشد.
- Nonfunctional WBCs & platelets 24 h after preservation

Anticoagulants

	CPD	CPD-A1
Storage time	21 days	35 days
Temperature	1-6 C	1-6 C
	Slows glycolytic activity	
Adenine	None	Substrate for ATP synthesis
Volume	450 +/- 10%	
Dextrose	Supports ATP generation by glycolytic pathway	
Citrate	Prevents coagulation by binding calcium	

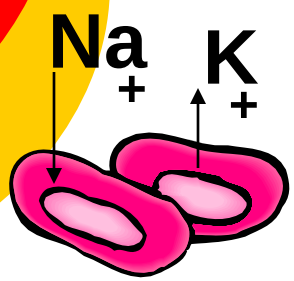
Additive Solution

- Remove platelet rich plasma within 72 hours
- Add additive solution to RBCs, ADSOL, which consists of SAGEM:
  - Saline
  - Adenine
  - Glucose
  - Mannitol: conteraindicated in newborn, neonate & in neurosurgery patients
- Extends storage to 42 days
- Final hematocrit approximately 66%

Changes Occur During Storage

- Shelf life = expiration date
  - At end of expiration must have 75% recovery at least 75% of transfused cells remain in circulation 24 hours after transfusion

Significant for infants & massive transfusion



Red Blood Cell

پتاسیم

آمونیاك

آهن

pH

ATP

2,3-DPG

Na^+

P50

Blood-Whole Blood

Fresh Whole Blood

Blood Products

Cellular Components-Red Cell Concentrates

Platelet Concentrates

Granulocyte Concentrate

Plasma Components-Fresh Frozen plasma

Cryoprecipitate

Cryopoor plasma

Stored plasma

Plasma Derivatives-Albumin

Immunoglobulin

Coagulation Factors

Shelf life (storage) lesion

- 1. افزایش بتاسیم
- 2- کاهش 2و3DPG.
- 3- کاهش ATP
- تولید مرفولوژي اسفیروسیت و اکینوسیت.
- 4- افزایش هموگلوبین آزاد در پلاسما.
- 5- افت PH
- 6- افزایش آمونیاك.
- 7- تجمع سیتوکاین ها و هیستامین ، پراکسیداز، IL-1β، IL-8 - 8فاکتور رشد سلولهاي اندوتلیال از بقایای پلاکت ها و گلبول هاي سفید
- 9-کاهش نیتریک اسید
- 10-کاهشP50

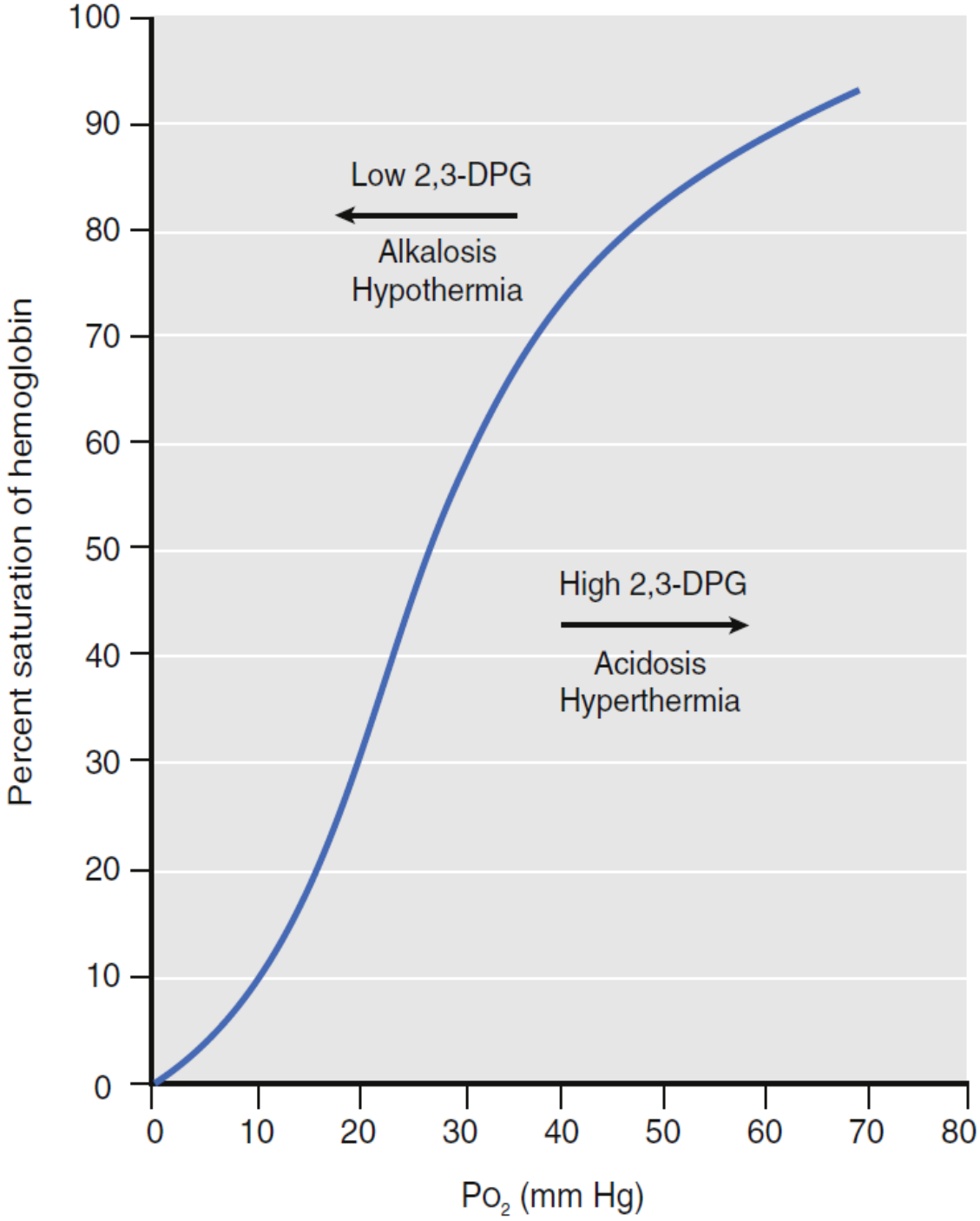
- 2,3-diphosphoglycerate (DPG) from stored red cells increase in hemoglobin's affinity for O2, RBC units stored for >1-2 weeks at least for the first 12 to 24 hours after transfusion.

- Beyond 7-10 days of storage, the P50 of hemoglobin decreases from 27➡16mmHg: Shifting the dissociation curve to the left.

- RBC units (>21 days old) were associated with a significantly increased risk of Transfusions of older death

Factors that shift the O_2 dissociation curve.

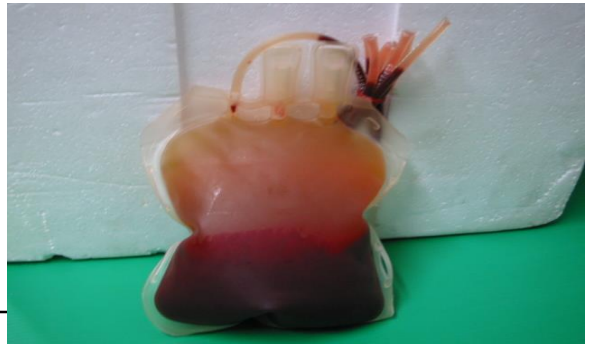
2,3-DPG, 2,3-Diphosphoglycerate.



خون تازه

- ~~تزريق خون داخل رحمي :کمتر از 3 روز~~
- جراحي قلب :کمتر از 10 روز
- ماسيو ترانسفيوژن
- نوزادان
- جهت جلوگیری از عوارضی همچون موارد زیر در کیسه خون بیش از 10-14 روز:
- افزايش آمونيوم: در بيماران كبدي
- افزايش پتاسيم: در بيماران كليوی
- افزايش آهن: تالاسمي
- افزايش سيتو كين و اينتر لوكين ها: افزايش عوارض

خون کامل (Whole blood)



- تزریق خون کامل همگروه ازنظر سیستم ABO و Rh با گیرنده الزامیست.
- در فردبالغ مصرف یک واحد از آن هموگلوبین را1g/dL و هماتوکریت را 3 درصدافزایش می دهد.
- حتما از ست تزریق خون باید استفاده شود.

Text book of Blood Banking and Transfusion Medicine 2007 by Sally V.Rudmann chapter14 page:370-396

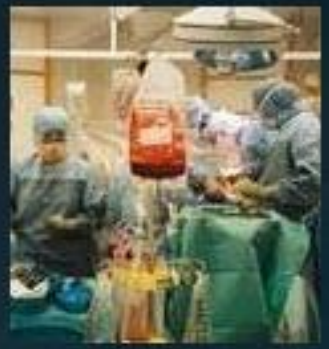
Whole Blood

- Clinical indications are **extremely limited.**
- Non-functional **platelet**
- Labile **coagulation factors.**
- Must be **ABO & Rh identical.**

Whole Blood

Indications

- Acute blood loss with hypovolaemia
- Exchange transfusion-severe anaemia at birth
  severe hyperbilirubinaemia
- Massive transfusion
- Cardiovascular bypass surgery



کانترا اندیکاسیون های مصرف خون کامل

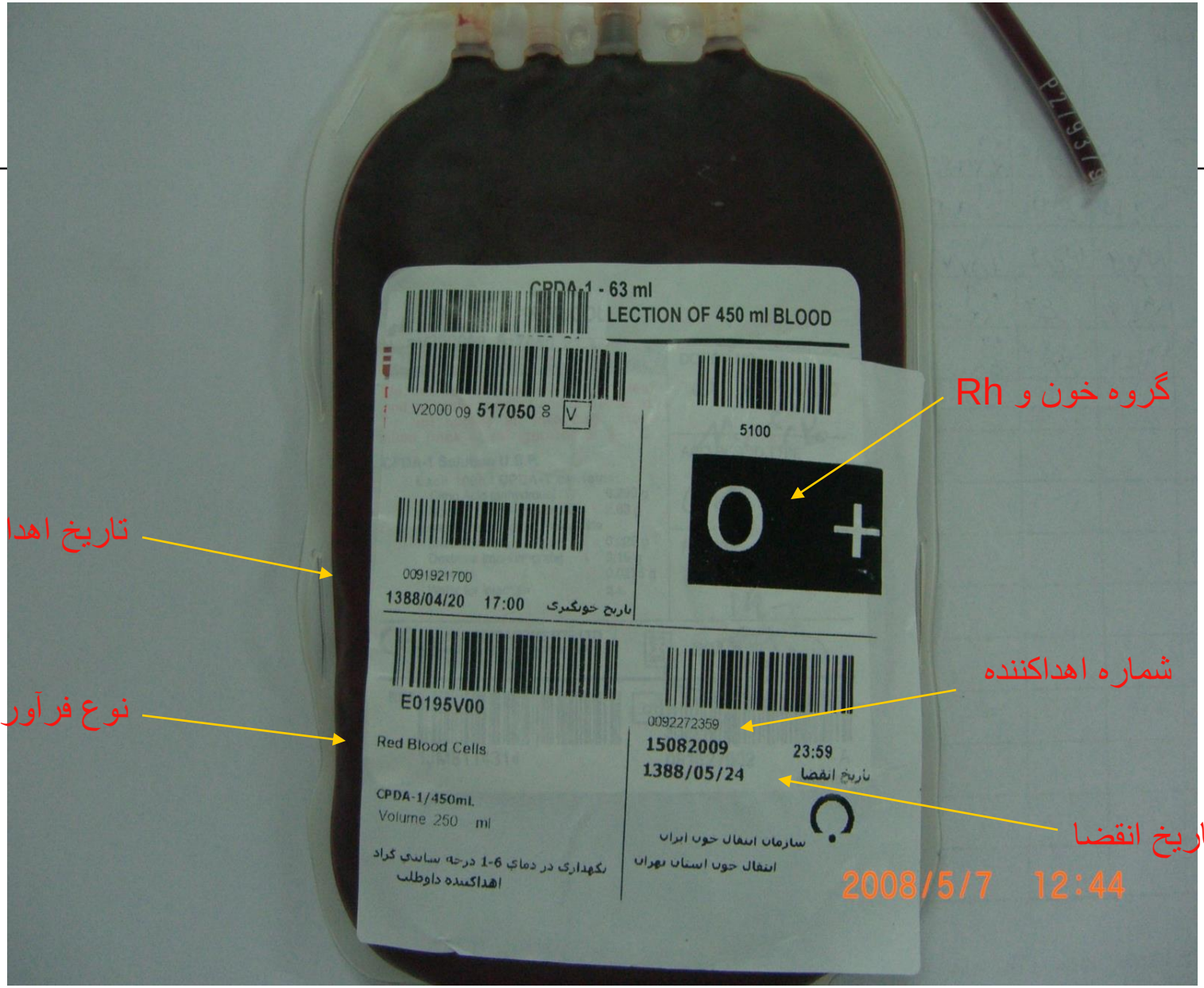
نارسایی احتقانی قلب

آنمی مزمن

گلبول قرمزفشرده (Packed-RBC)

- حجم هر واحد تقريبا 250ميلی ليتر است.
- هماتوکريت گلبول قرمز متراکم 65 تا 80 درصد مي باشد .
- مدت نگهداري (با ضد انعقاد CPDA-1) 35تا42 روز مي باشد
- دماي نگهداري خون کامل و خون فشرده 1-6 درجه سانتي گراد مي باشد.
- سرعت تزريق در بالغين 150-300 ميلي ليتر در ساعت
- در بچه ها 2-5 ميلي ليتربه ازائ هر کيلوگرم درساعت است.
- تزريق RBC هم گروه ويا سازگار ازنظر سيستم ABO با پلاسماي گيرنده الزاميست.
- در فردبالغ مصرف يک واحد از آن هموگلوبين را1 g/dLو هماتوکريت را 3-4 درصدافزايش می دهد.
- ودر اطفال تزريق به ميزان8-10ml/kg هموگلوبين را2 g/dLو هماتوکريت را6 درصدافزايش می دهد.

گلبول قرمز(RBC)



Whole Blood

Indications

- Acute blood loss with hypovolaemia
- Exchange transfusion-severe anaemia at birth
  severe hyperbilirubinaemia
- Massive transfusion
- Cardiovascular bypass surgery

BLOOD

- **Increase oxygen-carrying capacity**
- **Not to Increase intravascular volume**
- **Not consider only Hb values.**
- **Consider the overall status of the patient.**

- **Inadequate splanchnic perfusion when the Hb level decreased to 5.9g/dL.**
- **Increasing O-carrying capacity is the only real indication for blood transfusions**

The following key information is required

- 1.Overall condition of the patient
- 2.Assessment of anticipated blood loss
- 3.Measurement of blood loss
- 4.Quantitation of intravenous fluids given overall
- 5.Determination of Hb concentration

- تصميم گيري براي تزريق خون يك تصميم گيري باليني است .
- اكسيژناسيون بافتي تنها به ميزان هموگلوبين وابسته نيست.
- وضعيت قلبي ريوي بيمار
- فعاليت بدني
- سن
- حجم خون
- بيماری زمينه ای
- كم خونی حاد يا مزمن
  ميزان افت همو گلوبين
- وضعيت كلي علائم باليني بيمار بررسي شود .

Factors to consider include the symptomatic

- Anemia
- Dizziness
- Weakness
- Shortness of breath
- The patient's age
  - Underlying cardiac diseases
  - Pulmonary diseases
- Vascular disease.

Disease	Hb	HCT
Severe cardiopulmonary failure	<13	<40%
Mild to moderate Failure	<10	
Acute coronary syndromes	< 8	
Symptomatic Anemia	< 7	
Preop with probability of >500ml blood loss in op	< 9	
Uremia & bleeding due to thrombocytopenia	< 10	
Blood volume loss>25%	< 6	<20%
Sickle cell anemia - Acute splenic sequestration crises	< 5	
- Acute chest syndrome & CVA	10	HbS <30%
- General Anesthesia	10	HbS <60%

- **Hb value >10 g/dL rarely require blood transfusions**
- **Whereas patients with acute anemia <6 g/dL frequently require blood transfusions.**
- **Patients with chronic anemia (as in renal failure) might tolerate an Hb< 6-7 g/L.**

- **The indications for transfusion of autologous \more liberal than allogeneic RBCs**

- **1. Blood loss >20% of blood volume**
- **2. Hb < 8 g/dL in cardiac problem**
- **3. Hb<7 g/dl before surgery .**
- **4 . Hb <9-10 g/dL in major disease (emphysema, ischemic heart disease)**

5.Hb<7 in toxic & poor condition

- **4. Hb level <10 g/dL in autologous blood**
- **5. Hb level <11-12 g/dL in ventilator dependent**

- **Hb of 8.0 g/dL or less can be tolerated by if not critically ill or not severe cardiorespiratory disease.**

دستورالعمل تزریق خون

- تزریق خون در Hb>10 معمولا لازم نیست .
- در Hb<6 معمولا لازم است .
- در بیمار با وضعیت حاد و بحراني با Hb<7
- قبل از عمل جراحي Hb<9
- اورمي و ترومبوسیتوپني با خونریزی Hb<10
- نارسايي عروق كرونر با Hb<8
- میزان از دست رفتن خون 15%<

- Hb<8 with major disease (emphysemas , heart disease).
- Hb<11 autologus blood.
- Hb<12 Ventilator dependent.

GUIDE LINE FOR RBC TRANSFUSION

- - Hgb>10, rarely needed
- - Hgb <6, usually needed
- Hb,<,6gr% almost always need transfusion
- Hb<7critically ill pt except if have CVD Hb<8
- Hb<9g% before surgery with estimated blood loss more than 500 cc
- Hb<10 in uremic or thrombocytopenic bleeding
- Hb<8 in acute coronary syndrome
- Hb<8 CABG,Hct>24 risk Q wave MI,Hb>8 longer period ischemia
- Orthopedic surger Hb<8
- A cute blood loss > 15% volume correction result in decompensation cardiac output

Blood transfusion is an art

TABLE 20-1. Signs and Symptoms of Anemia vs Acute Blood Loss

Symptom	Anemia	Hypovolemia
Tachycardia	X	X
Palpitations	X	X
Cooling of extremities		X
Pallor	X	X
Hypotension		X
Reduced arterial pressure		X
Reduced central venous (jugular) pressure		X
Acidosis		X
Increased respirations		X
Decline in urinary output		X
Mental status changes		X
Weakness	X	
Headache	X	
Dizziness	X	X
Disorientation	X	X
Dyspnea	X	
Angina	X	

Miller's Anesthesiology textbook

TABLE 61-1 **AMERICAN COLLEGE OF SURGEONS CLASSES OF ACUTE HEMORRHAGE**

Factors	Class I	Class II	Class III	Class IV
Blood loss (mL)	750	750-1500	1500-2000	2000 or more
Blood loss (% blood volume)	15	15-30	30-40	40 or more
Pulse (beats/min)	100	100	120	140 or higher
Blood pressure	Normal	Normal	Decreased	Decreased
Pulse pressure (mm Hg)	Normal or increased	Decreased	Decreased	Decreased
Capillary refill test	Normal	Positive	Positive	Positive
Respirations per minute	14-20	20-30	30-40	35
Urine output (mL/hr)	30	20-30	5-10	Negligible
Central nervous system: Mental status	Slightly anxious	Mildly anxious	Anxious, confused	Confused, lethargic
Fluid replacement (3-1 rule)	Crystalloid	Crystalloid	Crystalloid + blood	Crystalloid + blood

TABLE 19-2. The Use of RBC Transfusion for Sickle Cell Disease Complications*

Complication	Transfusion Method (strength of recommendation)
Symptomatic severe acute chest syndrome (defined by an oxygen saturation <90% despite supplemental oxygen)	Exchange (strong)
Acute splenic sequestration and severe anemia	Simple (strong)
Acute stroke in children and adults: Initiate a program of monthly transfusions	Simple or exchange (strong)
Hepatic sequestration	Simple or exchange (moderate)
Intrahepatic cholestasis	Exchange or simple (consensus)
Multisystem organ failure	Exchange or simple (consensus)
Aplastic crisis	Simple (consensus)
Symptomatic anemia	Simple (consensus)
Child with transcranial Doppler reading >200 cm/s	Exchange or simple (strong)
Adults or children with previous clinically overt stroke	Exchange or simple (moderate)

*Adapted from Yawn et al.[24]

Leukocyte-reduced RBCs

- ~~Definition: Produced with < 70% of original white cells & > 80% original red cells.~~
- Leukocyte less than 5×10^6
- Methods
  - Centrifugation
  - Washing
  - Micro aggregate filter, 90-99% removal
  - Fourth generation filter, 99.9% removal
  - Prestorage leuko-depletion lower level of cytokine generation in blood bag during storage & lower risk of FNHTR
  - Bedside leukoreduction → hypotention

Leukocyte Reduction

Indications For Leukodepleted Blood

- Prevention of recurrent FNHTR
  - Prevention of alloimmunization to HLA

in multiply transfused pts or multiple pregnancy

- Prevention of CMV & HTLV transmission

To reduce the immunmodulatory effect of blood transfusion.

Wound infection in surgical patient

Post op infection

Thrombosis

organ failure

Indications under review

TRALI

Prevention of latent HIV reactivation

Not prevent GVHD

Leukocyte Reduces RBCs

- CMV is carried in WBCs (probably neutrophils) only
- Filtered products appear equivalent to CMV seronegative products in prevention of CMV seroconversion
- CMV seronegative products
  - Infant /neonatal, Organ transplant patients
  - If pt is CMV positive, give CMV positive products
  - HIV patients should be given CMV positive products, because CMV (-) can stimulates further immune reaction

Washed RBCs

- HCT 70 – 80%
- Volume 180 cc

- Washing removes plasma proteins, platelets, WBCs and micro aggregates which may cause febrile or urticaria reactions.
- ; 1-2 hours process
- Must used washed RBC within 24 hours of preparation because the system was opened
- Washing causes 10-20%RBC loss so more transfusion need
- Transfusion hazards as RBC

Indication of Washed Packed Red Blood Cells

- to reduce the recurrence of severe allergic or anaphylactic transfusion reactions to be caused by plasma proteins
- IgA deficient patients
- Post-transfusion purpura.
- Repeated febrile nonhemolytic transfusion reactions
- In hyperkalemic patient

Washed Red Blood Cells)

- Washing removes plasma proteins, platelets, WBCs and micro aggregates which may cause febrile or urticarial reactions.
- Patient requiring this product is the IgA deficient patient with anti-IgA antibodies.
- Prepared by using a machine which washes the cells 3 times with saline to remove &
- Expires 24 hours after unit is entered.

Irradiation of Components

- 2500 Rad
- Patients at greatest risk are:
  - severely immunosuppressed,
  - immunocompromised
  - receive blood donated by relatives
  - intrauterine transfusions

- Irradiation inactivates lymphocytes, leaving platelets, RBCs and granulocytes relatively undamaged.
- Must be labeled "irradiated".
- *Expiration date if Irridation in First14 days : till 28 d.*
- *Irridation after 14 days become 5 day after irridation*
- *48H after k doubled.*

Irradiation of Blood Components

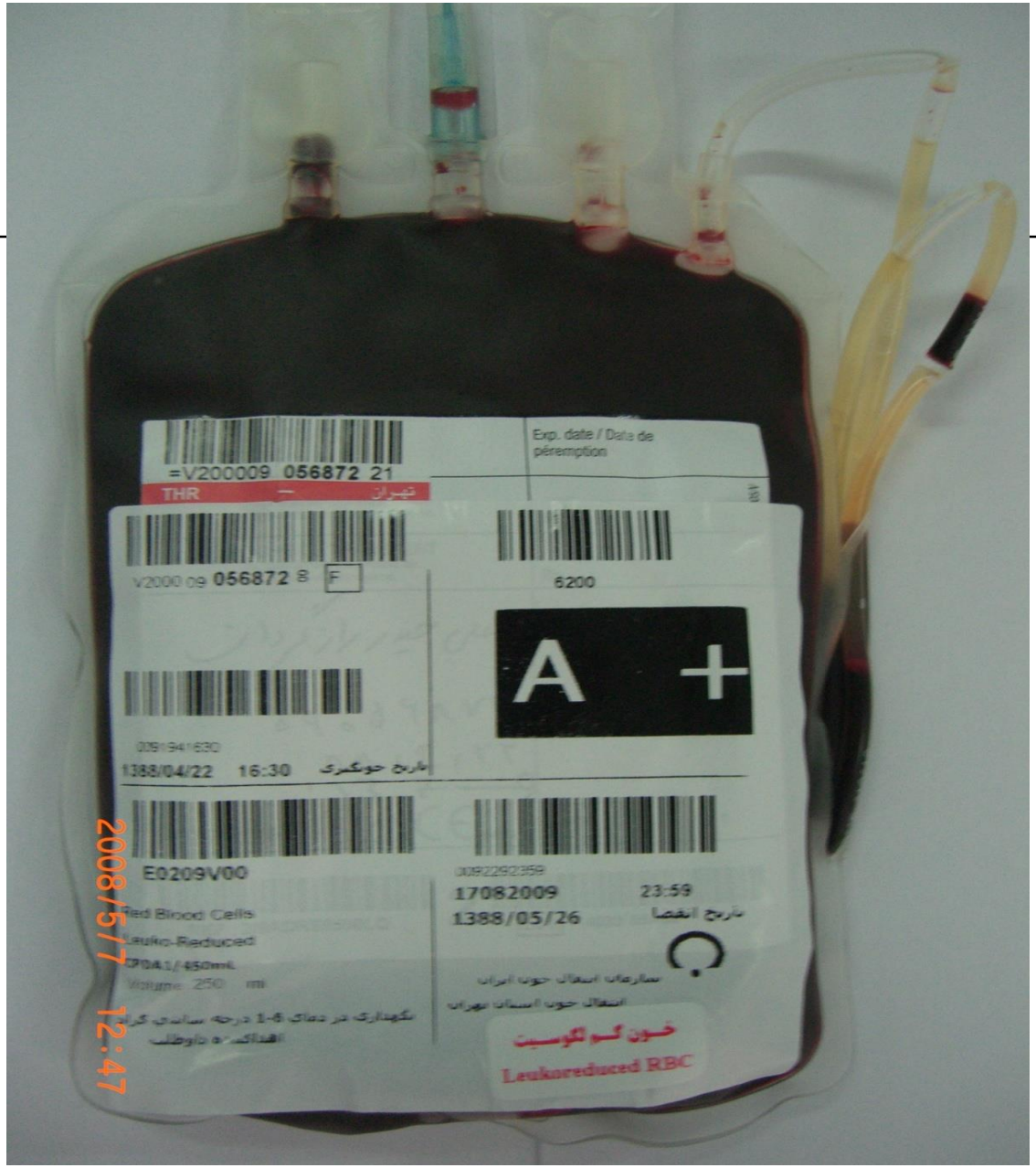
to destroy viable T- lymphocytes which *may cause Graft Versus Host Disease (GVHD).*

- GVHD is a disease that results when immunocompetent, viable lymphocytes in donor blood engraft in an immunocompromised host, recognize the patient tissues as foreign and produce antibodies against patient tissues.
- primarily skin, liver and GI tract.
- The resulting disease has serious consequences.

Clinical Indications for use of Irradiated Blood Components

Allogeneic & autologous

- Congenital cellular deficiency disorders
- Intrauterine transfusions
- Neonatal exchange transfusions
  (premature low birth wt<1500)
- Hodgkin's disease
- Aplastic anaemia patients on immunosuppressive therapy
- Patients receiving purine analogues, with associated immunosuppression
- HLA-matched single donor platelets
- Cellular components derived from near genetic relatives of the recipient (directed donations)
- Granulocyte transfusions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THR
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V2000 09 056872 8 F
6200
A +
1388/04/22 16:30
E0209V00
Red Blood Cells
Leuko-Reduced
17082009 23:59
1388/05/26
Leukoreduced RBC
2008/5/1 12:47

تذکر:تزریق خون همگروه از نظر ABOالزامیست مگردرموارد اورژانس که میتوان از تزریق خون سازگار از نظر ABOدرصورت نیاز نیز استفاده نمود .

- **Henry's Clinical Diagnosis & Laboratory Management By Laboratory Methods. 2007**
- chapter 35 page:669-684

Transfusion safety

ABO compatibility rules

plasma = Donor	Patient = Recipient: A	B	AB	O
A	Yes	No	No	Yes
B	No	Yes	No	Yes
AB	Yes	Yes	Yes	Yes
O	No	No	No	Yes

- **Henry's Clinical Diagnosis & Laboratory Management By Laboratory Methods. 2007**
- chapter 35 page:669-684

- Every Rh negative patient have one time chance to receive Rh positive component
- Not important acute problem
- Some non-responder
- Only late extavascualer hemolysis : Rhogam
- Menopause or old age

- Anti-D antibodies are not constitutively present in the serum of an Rh-negative patient.
- 60-70% of Rh- patients exposed to Rh+ RBCs will develop anti-D antibodies
- There is a latency period before the antibodies are synthesized

Transfuse

Rhogam till 72h after transfusion

1ug Amp = 1cc PRBC or

2cc whole blood

1 vial Rhogam=300ug for 30 cc whole blood

Or 15cc packed RBC

If transfuse 200cc whole blood to Pt

200 / 30=6.6=7=8

If transfuse 200cc packed RBC to Pt

200/15=13.2=14

Massive transfusion

In massive bleeding ; blood loss>50% , bleeding>150ml/min

8-10 RBC unit tranfused<24h

-*Na citrate toxicity ;*

Hypo ca & Mg

-Cardiac dyscontractility & arrhythmia

-Liver transplantation

- *Hyperkalemia*

-Renal failure

-Neonate & Pediatric age group

-Hypovolemic shock

-***Hypothermia ; blood warmer***

Core temp < 34°c

-Plt dysfunction

-Slow metabolic Path

Core temp < 30°c

-Tachycardia & vent fibrillation

-***Decreased 2,3 DPG ; shelf – life lesion***

Blood unit >14 days ; 2,3 DPG:0

P50 :27→16 : Shift to the Lt.

24-48 h for restoration

Dilutional coagulopathy

-Wash – out & dilution of plt & CF

- Plt drop to 1:3 (210,000 → 70, 000)

-PT & PTT > ×1.5 NL → capillary bleeding

Neuro & ophthalmology;

microvascular bleeding

→ PT & PTT >1.3 ULN → FFP

- PT > x1.5 NL ≃ INR2 (ISI:2)

-Fibrinogen level>100mg%

-Plt >75-100×10^3

2 unit cryo/10kg: 50-100mg↑ Fibrinogen level

- **To Initiate massive transfusion :**

10 RBC units/6 RDP or 1SDP+2FFP

Compatibility Testing in Massive Transfusion

-ABO & RH Typing : 10-15 min

-Cross match : 45-60 min

-Immediate spin cross match

-Group O Neg

-Rh IG : 72 h after D+transfusion in D- patient

Use of whole blood

-Decreased Factor V & VIII During storage

- **Useful for concomitant red cell &**
  Volume deficits &
  Active bleeding as liver transplantation

TABLE 27-1. Categories of Adverse Transfusion Reactions and Their Management*

Type	Incidence	Etiology	Presentation	Diagnostic Testing	Therapeutic/Prophylactic Approach
Acute (<24 hours) Transfusion Reactions—Immunologic					
Hemolytic	ABO Rh mismatch: 1 in 40,000 AHTR: 1 in 76,000 Fatal HTR: 1 in 1.8 million	Red cell incompatibility	Chills, fever, hemoglobinuria, hypotension, renal failure with oliguria, DIC (oozing from IV sites), back pain, pain along infusion vein, anxiety	Clerical check DAT Visual inspection (free Hb) Repeat patient ABO, pre- and posttransfusion sample Further tests as indicated to define possible incompatibility Further tests as indicated to detect hemolysis (LDH, bilirubin, etc)	Keep urine output >1 mL/kg/hr with fluids and IV diuretic (furosemide) Analgesics (may need morphine) Pressors for hypotension (low-dose dopamine) Hemostatic components (platelets, cryoprecipitate, or FFP) for bleeding
Febrile, nonhemolytic	0.1 to 1% with universal leukoreduction	Accumulated cytokines in platelet unit Antibody to donor WBCs	Fever, chills/rigors, headache, vomiting	Rule out hemolysis (DAT, inspect for hemoglobinemia, repeat patient ABO) Rule out bacterial contamination WBC antibody screen†	Leukocyte-reduced blood Antipyretic premedication (acetaminophen, no aspirin)
Urticarial	1:100-1:33 (1%-3%)	Antibody to donor plasma proteins	Urticaria, pruritis, flushing	Rule out hemolysis (DAT, inspect for hemoglobinemia, repeat patient ABO)	Antihistamine, treatment or premedication (PO or IV) May restart unit slowly after antihistamine if symptoms resolve

Type	Incidence	Etiology	Presentation	Diagnostic Testing	Therapeutic/Prophylactic Approach
Anaphylactic	1:20,000-1:50,000	Antibody to donor plasma proteins (includes IgA, haptoglobin, C4) Cytokines	Hypotension, urticaria, bronchospasm (respiratory distress, wheezing), local edema, anxiety	Rule out hemolysis (DAT, inspect for hemoglobinemia, repeat patient ABO) Anti-IgA IgA, quantitative	Trendelenburg (feet-up) position Fluids Epinephrine (adult dose: 0.2-0.5 mL of 1:1000 solution SC or IM; in severe cases, 1:10,000 IV, initial rate 1mcg/minute) Antihistamines, corticosteroids, beta-2 agonists IgA-deficient blood components
TRALI	1:1,200-1:190,000	WBC antibodies in donor (occasionally in recipient), other WBC-activating agents in components	Hypoxemia, respiratory failure, hypotension, fever, bilateral pulmonary edema	Rule out hemolysis (DAT, inspect for hemoglobinemia, repeat patient ABO) Rule out cardiogenic pulmonary edema WBC antibody screen in donor and recipient. If positive, antigen typing may be indicated WBC crossmatch Chest X-ray	Supportive care until recovery Deferral of implicated donors

Transfusion-associated sepsis	Varies by component (see Infectious Disease Screening, Chapter 8)	Bacterial contamination	Fever, chills, hypotension	Gram's stain Culture of component Patient culture Rule out hemolysis (DAT, inspect for hemoglobinemia, repeat patient ABO)	Broad spectrum antibiotics (until sensitivities completed) Treat complications (eg, shock)
Hypotension associated with ACE inhibition	Dependent on clinical setting	Inhibited metabolism of bradykinin with infusion of bradykinin (negatively charged filters) or activators of prekallikrein	Flushing, hypotension	Rule out hemolysis (DAT, inspect for hemoglobinemia, repeat patient ABO)	Withdraw ACE inhibition Avoid albumin volume replacement for plasmapheresis Avoid bedside leukocyte filtration
Circulatory overload	<1%	Volume overload	Dyspnea, orthopnea, cough, tachycardia, hypertension, headache	Chest X-ray Rule out TRALI	Upright posture Oxygen IV diuretic (furosemide) Phlebotomy (250-mL increments)
Nonimmune hemolysis	Rare	Physical or chemical destruction of blood (heating, freezing, hemolytic drug or solution added to blood)	Hemoglobinuria, hemoglobinemia	Rule out patient hemolysis (DAT, inspect for hemoglobinemia, repeat patient ABO) Test unit for hemolysis	Identify and eliminate cause
Air embolus	Rare	Air infusion via line	Sudden shortness of breath, acute cyanosis, pain, cough, hypotension, cardiac arrhythmia	X-ray for intravascular air	Place patient on left side with legs elevated above chest and head

Type	Incidence	Etiology	Presentation	Diagnostic Testing	Therapeutic/Prophylactic Approach
Hypocalcemia (ionized calcium; citrate toxicity)	Dependent on clinical setting	Rapid citrate infusion (massive transfusion of citrated blood, delayed metabolism of citrate, apheresis procedures)	Paresthesia, tetany, arrhythmia	Ionized calcium Prolonged Q-T interval on electrocardiogram	PO calcium supplement for mild symptoms during therapeutic apheresis procedures Slow calcium infusion while monitoring ionized calcium levels in severe cases
Hypothermia	Dependent on clinical setting	Rapid infusion of cold blood	Cardiac arrhythmia	Central body temperature	Employ blood warmer
Delayed (>24 hours) Transfusion Reactions—Immunologic					
Alloimmunization, red cell antigens	1:100 (1%)	Immune response to foreign antigens on RBCs	Positive blood group antibody screening test	Antibody screen DAT	Avoid unnecessary transfusions Leukocyte-reduced blood
Alloimmunization, HLA antigens	1:10 (10%)	WBCs and platelets (HLA)	Platelet refractoriness, delayed hemolytic reaction, hemolytic disease of the newborn	Platelet antibody screen HLA antibody screen	Avoid unnecessary transfusions Leukocyte-reduced blood
Hemolytic	1:2500-11,000	Anamnestic immune response to red cell antigens	Fever, decreasing hemoglobin, new positive antibody screening test, mild jaundice	Antibody screen DAT Tests for hemolysis (visual inspection for hemoglobinemia, LDH, bilirubin, urinary hemosiderin as clinically indicated)	Identify antibody Transfuse compatible RBCs as needed

Graft-vs-host disease	Rare	Donor lymphocytes engraft in recipient and mount attack on host tissues	Erythroderma, maculopapular rash, anorexia, nausea, vomiting, diarrhea, hepatitis, pancytopenia, fever	Skin biopsy HLA typing Molecular analysis for chimerism	Corticosteroids, cytotoxic agents Irradiation of blood components for patients at risk (including components from related donors and HLA-selected components)
Posttransfusion purpura	Rare	Recipient platelet antibodies (apparent alloantibody, usually anti-HPA-1a) destroy autologous platelets	Thrombocytopenic purpura, bleeding 8-10 days after transfusion	Platelet antibody screen and identification	IVIG HPA-1a-negative platelets Plasmapheresis
Delayed (>24 hours) Transfusion Reactions—Nonimmunologic					
Iron overload	Typically after >100 RBC units	Multiple transfusions with obligate iron load in transfusion-dependent patient	Diabetes, cirrhosis, cardiomyopathy	Serum ferritin Liver enzymes Endocrine function tests	Iron chelators

*For platelet refractoriness, see chapter on platelet and granulocyte antigens and antibodies; for septic transfusion reactions, see chapter on transfusion-transmitted diseases. For a recent summary of transfusion reactions, see Popovsky.[4]

†Blood group antibody screening test.

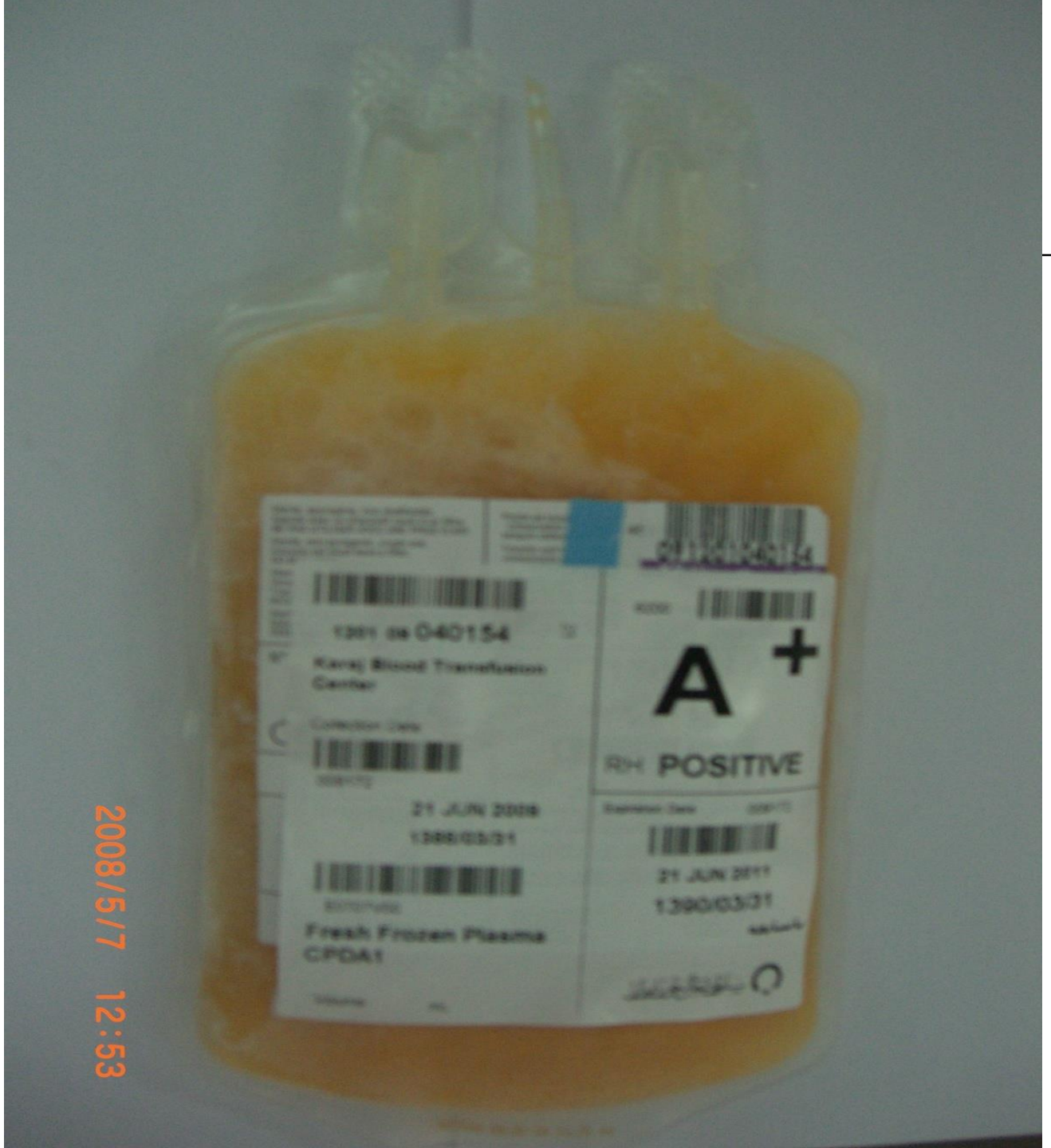
AHTR = acute hemolytic transfusion reaction; HTR = hemolytic transfusion reaction; DIC = disseminated intravascular coagulation; DAT = direct antiglobulin test; IV = intravenous; Hb = hemoglobin; LDH = lactate dehydrogenase; CRYO = cryoprecipitated antihemophilic factor; FFP = fresh frozen plasma; WBC = white blood cell; PO = by mouth; SC = subcutaneous; IM = intramuscular; IgA = immunoglobulin A; ACE = angiotensin-converting enzyme; TRALI = transfusion-related acute lung injury; RBC = Red Blood Cell; IVIG = intravenous immunoglobulin; HPA = human platelet antigen.

پلاسماي تازه منجمد

Plasma Fresh Frozen

- حجم هر واحد تقريباً 200-250 ميلی ليتر است.
- دماي مطلوب 30- درجه سانتي گراد يا پائين تر است ولي مي توان در 18- درجه سانتي گراد نيز نگهداري كرد كه چنانچه در اين برودت نگهداري شود، می توان تا سه ماه (EUROPE OF COUNCIL,IBTO SOP) به عنوان منبعي غني از فاكتورهاي انعقادي پايدار و غير پايدار از آن استفاده كرد .
- اين فرآورده داراي مقادير نرمال فاكتورهاي انعقادي , آلبومين , ايمونوگلوبولين و آنتي ترومبين مي باشد.

AABB TECHNICAL MANUAL 2008 PAGE:200-220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Fresh Frozen Plasma پلاسماي تازه منجمد

* در هنگام استفاده از **FFP** بايد آن را در **37** درجه سانتي گراد ذوب كرد و پس از ذوب شدن در عرض حداكثر **4** ساعت مصرف كرد.
  - چنانچه پلاسمايي پس از ذوب شدن مورد استفاده قرار نگيرد، مي توان آن را در يخچال در دماي **1** تا **6** درجه سانتي گراد گذاشت و تا **24** ساعت، هنوز هم به عنوان پلاسماي تازه مورد استفاده قرار داد.
* سرعت تزريق در بالغين: **200-300**ميلي ليتردرساعت
* سرعت تزريق در بچه ها: **60-120**ميلي ليتردرساعت
* بايد از طريق فيلتر **170-260** ميكروني (صافي استاندارد) تزريق شود.

AABB TECHNICAL MANUAL 2008 chapter6 PAGE:200-210 & 620

پلاسماي تازه منجمد

Fresh Frozen Plasma

***ميزان درماني پلاسما جهت تصحيح فاکتورهاي انعقادي**

10 cc تا 20 cc به ازاي هر کيلوگرم وزن بيمار است .

-Henry's Clinical Diagnosis & Laboratory Management By Laboratory Methods. 2007 chapter 35 page:669-684

اندیکاسیون های مهم تزریق پلاسما: (FFP)

- کمبود چندین فاکتور انعقادي
- -کوآگولوپاتي رقتي
- -خونریزي در بیماري کبدی
- -انعقاد داخل رگي منتشر (DIC)
- برگشت سریع اثر وارفارین درموارد خونریزی یا نیاز به جراحی
- TTP
- PT,PTTبیش از 1/5برابرمیانگین طیف مرجع
- کمبود فاکتورهاي انعقادي (در صورت عدم دسترسي به کنسانتره فاکتور)

Henry's Clinical Diagnosis & Laboratory Management By Laboratory Methods. 2007 chapter 35 page:669-684

TABLE 20-7. Guidelines for Correction of Excessive Oral Anticoagulation*

Clinical Situation	Guideline
INR >therapeutic but <5, no significant bleeding	Lower anticoagulant dosage.
	Temporarily discontinue drug if necessary.
INR >5 but <9, no significant bleeding	Omit 1-2 doses; monitor INR; resume when in therapeutic range.
	Alternative if patient at increased risk of hemorrhage: ◆ Omit a dose and give 1 to 2.5 mg vitamin K_1 orally. ◆ For rapid reversal before urgent surgery: give 2 to 4 mg vitamin K_1 orally; repeat dose with 1 to 2 mg at 24 hours if INR remains elevated.
INR >9, no significant bleeding	Omit warfarin; give 2.5-5.0 mg vitamin K_1 orally.
	Closely monitor INR; give additional vitamin K_1 if necessary.
	Resume warfarin at lower dose when INR is within therapeutic range.
Serious bleeding at any elevation of INR	Omit warfarin.
	Give 10 mg vitamin K_1 by slow intravenous infusion.
	Supplement with plasma or prothrombin complex concentrate depending on urgency of correction.
	Vitamin K_1 infusions can be repeated every 12 hours.
Life-threatening hemorrhage	Omit warfarin.
	Give prothrombin complex concentrate with 10 mg vitamin K_1 by slow intravenous infusion.
	Repeat as necessary, depending on INR.

*Adapted from Ansell et al[39]; guidelines developed and vetted by the American College of Chest Physicians.
INR = international normalized ratio.

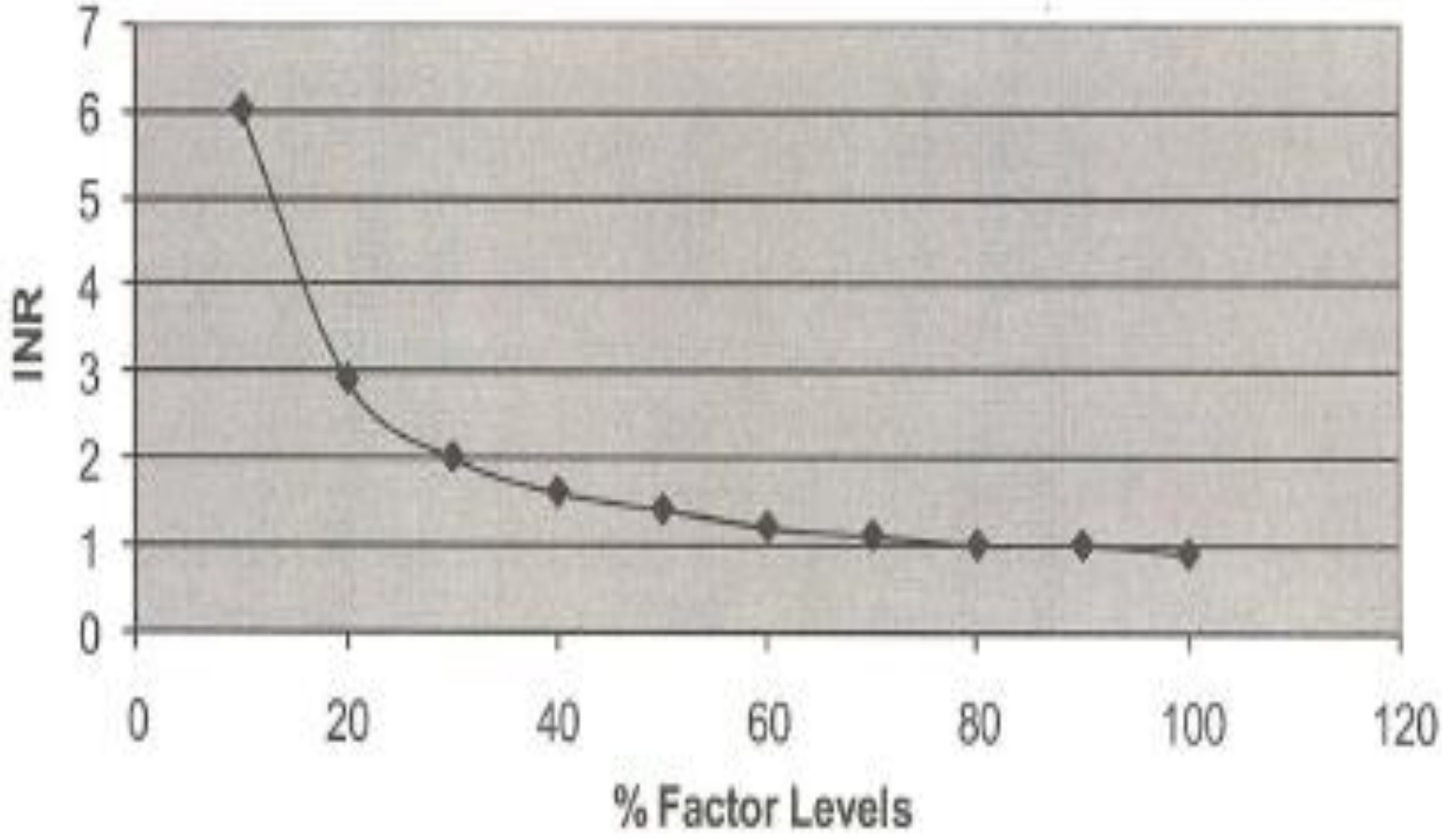


FIGURE 20-2. Exponential relationship of INR to percentages of factor levels. (Used with permission from Wayne Chandler, MD, University of Washington Department of Laboratory Medicine.)

کانترا اندیکاسیون های تزریق پلاسما

1- افزایش حجم

2- جایگزینی ایمونوگلوبولین ها در نقص ایمني

3- حمایت تغذیه ای

4- ترمیم زخم

Blood Banking & Transfusion Medicine;Hillyer;Second Edition;Table 19.1;page:260;2007

پلاسماي تازه منجمد

Fresh Frozen Plasma

- درتزريق پلاسما احتياجي به كراس مچ نيست ولی همگروهي سيستم ABO بين دهنده و گيرنده را بايد رعايت كرد و چنانچه پلاسماي همگروه AB يا سازگار با بيمار يافت نشود , مي توان از پلاسماي اهداكننده گروه A به عنوان دهنده همگاني پلاسما استفاده كرد، چون اين افراد فاقد آنتي B و آنتي B هستند .
- تجويز روتين RhIG بعد از تزريق حجم هاي نسبتا كوچك پلاسما انديكاسيون نداشته اگرچه منطقي است در خانمهاي Rhمنفي در سنين باروري كه تحت plasma exchangeمي گيرند هر3هفته يكبار RhIG به ميزان 50 ميكروگرم دريافت نمايند.

-Henry's Clinical Diagnosis & Laboratory Management By Laboratory Methods. 2007 chapter 35 page:669-684
-Transfusion Therapy :Clinical Principles and Practice;page429-430;2005

Side effects of FFP

- Fever , chills & allergic reactions

-Server allergic reactions with bronchospasm &

-TRALI ; noncardiogenic pulmonary edema (HLA Abs in donor plasma react with recipient WBC) or ; third leading cause of mortality related to transfusion ,underdiagnosed because can occur in extremely ill patients

-Anaphylactic reactions ;

IgA / Haptoglobin containg plasma infusion in to IgA def.

-Transfusion Transmitted infectious disease

Side effects of FFP

1- Fever chills & allergic reactions

2- Occasionally server allergic reactions with bronchospasm &

3-TRALI (noncardiogenic pulmonary) edema

HLA Abs in donor plasma react with recipient WBC) or; third leading cause of mortality related to transfusion underdiagnosed because can occur in extremly ill patients ; especially if Donor is Lady

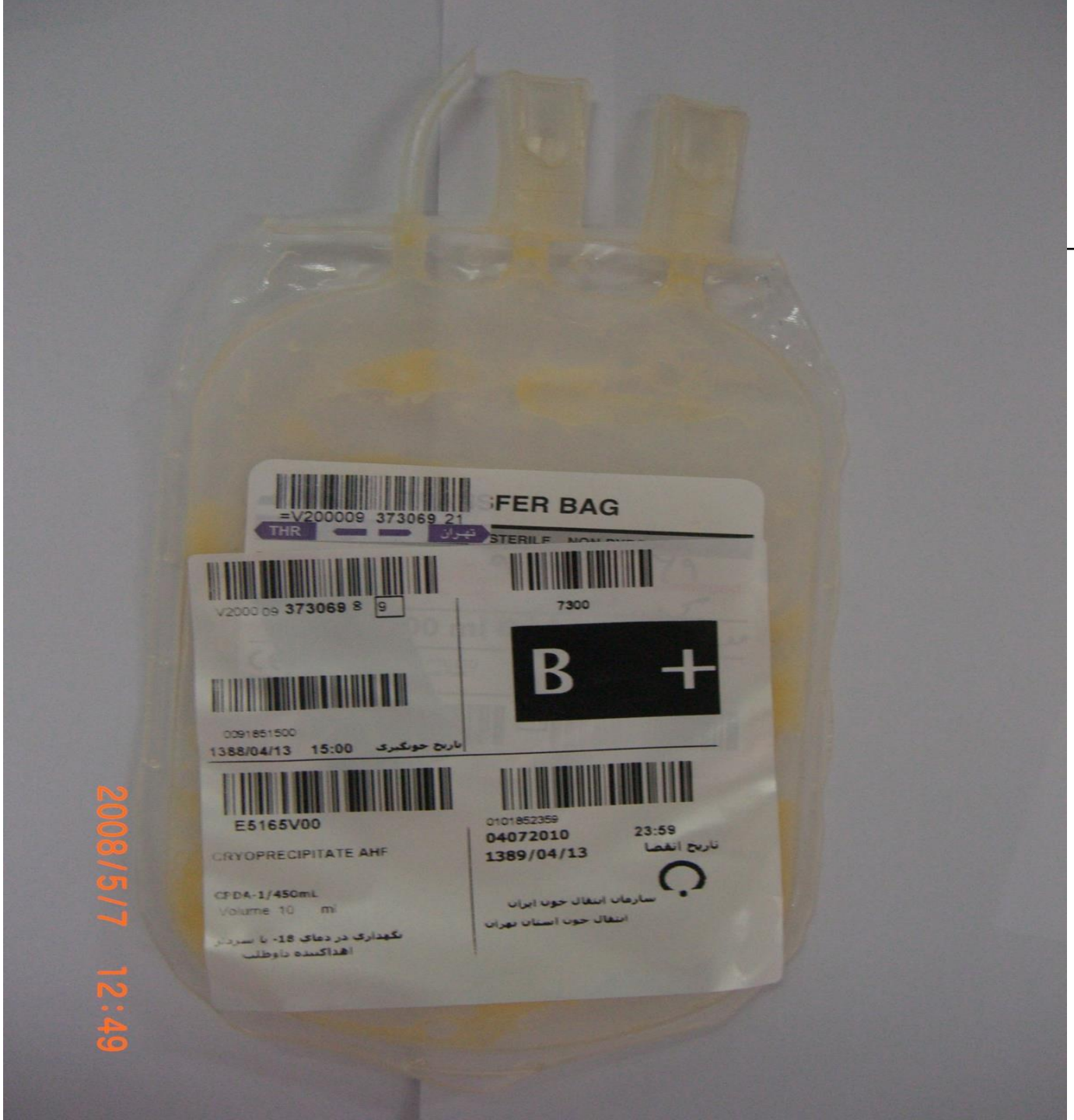
4-Anaphylactic reactions ;

IgA containg plasma infusion in to IgA def.

5- Transmission of infectious disease

کرایو پرسیپیتات (Cryoprecipitate)

- حجم هر واحد تقریبا 15 میلی لیتر است.
- کرایو بخشي از پلاسماي تازه بوده که در سرما غیر محلول است
- کرایو را پس از تهیه باید هرچه زودتر مصرف نمود و یا حداکثر در عرض دو ساعت پس از تهیه در دماي 30- درجه سانتي گراد منجمد شود.
- کرایو باید از طریق فیلتر 170-260 میکروني (فیلتر یا صافي استاندارد) تزریق شود.
- فرآورده باید در دماي 25- درجه سانتي گرادوپایین ترحداکثر تا سه سال نگهداري شود.
- در دمای 18- درجه تا سه ماه قابل نگهداری است. (IBTO SOP)
- AABB TECHNICAL MANUAL chapter6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کرايو پرسيپيتات (Cryo precipitate)

- براي مصرف کرايو ابتدا بايد در 37 درجه سانتي گراد ذوب شود و پس از ذوب شدن نبايد دوباره منجمد گردد و لازم است هر چه سريعتر مصرف گردد.پس از ذوب شدن فقط حداکثرتا 6 ساعت در دماي اتاق قابل نگهداري و مصرف است .
- سرعت تزريق بسته به تحمل بيمارداشته و بايد هرچه سريعتر تزريق شود.
- استفاده از فرآورده سازگار ازنظر ABO به ويژه براي کودکان که حجم خون آنها کم است ارجحيت دارد اما انجام آزمايش سازگاري قبل از تزريق لازم نمي باشد.وچون اين فرآورده حاوي گلبول قرمز نمي باشد انجام آزمايش Rh هم لازم نيست.

1-Blood Banking & Transfusion Medicine;Hillyer;Second Edition;page:271;2007
2-AABB TECHNICAL MANUAL 2008 chapter21 PAGE:613-622

کرايو پرسيپيتات (Cryo precipitate)

*ميزان مصرف كرايوبستگي به عوامل مختلفي داشته و به عنوان مثال براي هيپو فيبرينوژنميا معمولاً يك واحد (كيسه) به ازاء هر 5 تا 10 كيلوگرم وزن بدن مي باشد

1-AABB TECHNICAL MANUAL chapter6 PAGE
2-Blood Banking & Transfusion Medicine;Hillyer;Second Edition

Cryoprecipitate

- 10-15 ml per unit (bag)
- Fibrinogen 150-250 mg
- Factor VIII 80-120 units
- Von Willebrand Factor 40-70% of FFP
- Factor XIII 20-30% of FFP
- Fibronectin 20-40 mg

اندیکاسیون هاي مهم تزریق رسوب کرایو

1. کمبود فاکتور 8 (در صورت عدم دسترسي به کنسانتره فاکتور)
2. بیماري فون ویلبراند (در صورت عدم دسترسي به کنسانتره فاکتور)
3. هیپوفیبرینوژنمي
4. کمبود فاکتور 13
5. خونریزي اورمیك (DDAVP در این حالت ارجحیت دارد)
6. چسب فیبرین موضعي

Henry's Clinical Diagnosis & Laboratory Management By Laboratory Methods; chapter 35

Cryo Poor Plasma (CPP)

- حجم آن حدود 200 سي سي مي باشد نام ديگر اين فرآورده Cryo Precipitate-Reducedمي باشد .
- اين فرآورده حاوي مقادير خيلي كم فيبرينوژن، فاكتورVIIIC و فاكتور فون ويلبراند مي باشد ليكن ساير فاكتورهاي پلاسمائي را به حد كافي دارد .
- در درمان بيماران مبتلا به TTP كاربرد دارد.

AABB TECHNICAL MANUAL, chapter26

پلاکت متراکم

Random donor Platelets

Whole blood 1 unit → Platelet Concentrate 1 unit

↓

$\geq 5.5 \times 10^{10}$ platelets in

50 - 70 ml of plasma

3 days

Single donor platelets

1 Donor →

Platelet concentrate

↓

$\geq 3 \times 10^{11}$ platelets in

~ 300 ml of plasma

3 days

- Henry's Clinical Diagnosis & Laboratory Management By Laboratory Methods. chapter 35

پلاكت متراكم (Platelet concentration)

- نگهداري در دماي 2 ± 22 درجه سانتي گراد (درجه حرارت اطاق) همراه با تكان دادن و آژيتاسيون ملايم و دائمي تا 3 روز در سيستم بسته امكان پذير است .
- پلاكت هايي كه در درجه حرارت اتاق نگهداري مي شوند از نظر انعقادي از كارآيي بهتري برخوردار هستند .

* سرعت تزريق در بالغين: 200-300ميلي ليتردرساعت

* سرعت تزريق در بچه ها: 60-120ميلي ليتردرساعت

- حجم:50 - 70ميلي ليتر

AABB TECHNICAL MANUAL, chapter6 PAGE:189-225, 2008

پلاکت متراکم (Platelet concentration)

*تزریق پلاکت با پلاسمای همگروه ویا سازگار ازنظر سیستمABOبا گلبول قرمز گیرنده توصیه میگردد.

بیماران Rhمنفی بایستی پلاکت Rhمنفی دریافت نمایند به خصوص در بچه ها و بازنان در سنین باروری .در غیر این صورت باید از ایمونوگلوبولین Rhاستفاده شود.

*دز مناسب تزریق در بالغین به خوبي تعیین نشده است، ولي مي توان پاسخ در ماني به تزریق را با محاسبه CCI امکانپذیر نمود.

معمولا یک دوز درماني براي يك بيمار بالغ به 5 واحد یا بیشتر نیاز دارد.

*تزریق هر واحد پلاکت رندوم 5000-10000در میکرولیتروپلاکت آفرزیس 30000-60000 در میکرولیترپلاکت را افزایش می دهد.

1-Text book of Blood Banking and Transfusion Medicine, by Sally V.Rudmann chapter14
2-Henry's Clinical Diagnosis & Laboratory Management By Laboratory Methods. chapter 35
3-Blood Banking & Transfusion Medicine;Hillyer;p:326:2007

اندیکاسیون هاي مهم تزریق پلاکت

*ترومبوسیتوپني به علت کاهش تولید پلاکت :

- پایدار سازي وضعیت بیمار Plt<10,000

-در صورتي که بیمار تب دارد Plt<20,000

*در صورت خونریزي یا انجام اقدامات تهاجمي یا جراحي:

Plt<40,000-50,000

*در صورت خونریزي شبکیه یا CNS وخونریزي عروق کوچك به علت اختلال عملکرد پلاکت:

Plt<100,000

Henry's Clinical Diagnosis & Laboratory Management By Laboratory Methods. 2007 chapter 35 page:669-684

Platelets: Risk of Spontaneous Hemorrhage

Count	Site
> 40,000	Minimal
20-40,000	GI Mucosa
5-20	Skin, Mucus Membranes
< 5	CNS, Lung

TABLE 18-1. Blood Component Transfusions in Nonemergent Settings

Component	Suggested Adult Flow Rates		Special Considerations	ABO Compatibility	Filter
	First 15 Minutes	After 15 Minutes			
Red Blood Cells (RBCs)	1-2 mL/min (60-120 mL/hour)	As rapidly as tolerated; approximately 4 mL/minute or 240 mL/hour	Infusion duration should not exceed 4 hours. Generally administered over 1-2 hours for hemodynamically stable recipients. For recipients at risk of fluid overload, may adjust flow rate to as low as 1 mL/kg/hour.	Whole blood: ABO identical RBCs: ABO compatible with recipient's plasma Crossmatch required	In-line (170-260 micron) Leukocyte reduction if indicated
Platelets	2-5 mL/min (120-300 mL/hour)	300 mL/hour or as tolerated	Usually given over 1-2 hours. For recipients at risk of fluid overload, use slower flow rate (see RBCs).	Crossmatch not required ABO/Rh compatibility preferable but not required May be HLA matched	In-line (170-260 micron) Leukocyte reduction if indicated
Plasma	2-5 mL/min (120-300 mL/hour)	As rapidly as tolerated; approximately 300 mL/hour	Time for thawing may be needed before issue. For recipients at risk of fluid overload, use slower flow rate (see RBCs).	Crossmatch not required ABO compatibility with recipient red cells	In-line (170-260 micron)
Granulocytes	1-2 mL/min (60-120 mL/hour)	120-150 mL/hour or as tolerated	Over approximately 2 hours. Infuse as soon as possible after collection/release of component; irradiate.	Crossmatch required ABO/Rh compatibility required May be HLA matched	In-line (170-260 micron) Do not use leukocyte reduction or microaggregate filters
Cryoprecipitated AHF	As rapidly as tolerated		Infuse as soon as possible after thawing; pooling is preferred.	Crossmatch and ABO compatibility not required	In-line (170-260 micron)

TABLE 19-5. Summary of AABB Recommendations for Prophylactic Platelet Transfusion in Adults[56]

Clinical Setting	PLT Transfusion May Be Indicated for:	Strength of Recommendation	Quality of Evidence
Therapy-related hypoproliferative thrombocytopenia	PLT count ≤10,000/μL	Strong	Moderate
Central venous catheter placement	PLT count <20,000/μL	Weak	Low
Diagnostic lumbar puncture	PLT count <50,000/μL*	Weak	Very low
Major elective nonneuraxial surgery	PLT count <50,000/μL	Weak	Very low
Cardiac surgery with bypass	Perioperative bleeding with thrombocytopenia and/or evidence of PLT dysfunction. Routine PLT prophylaxis not recommended.	Weak	Very low
Intracranial hemorrhage on anti-PLT therapy	Insufficient evidence for recommendation	Uncertain	Very low

*Clinical judgment should be used for patients with PLT counts between 20,000 and 50,000/μL.
PLT = platelet.

TABLE 19-6. Causes of Platelet Refractoriness[81]

Nonimmune	Immune
Fever	HLA antibodies
Medications (eg, amphotericin, vancomycin)	ABO incompatibility
Splenomegaly	Human platelet antigen (HPA) antibodies
Sepsis	Drug-dependent autoantibodies
Disseminated intravascular coagulation	
Hemorrhage	
Veno-occlusive disease	
Graft-vs-host disease	
Prolonged platelet storage	

کانتر اندیکاسیون

*تزریق پلاکت درITP اندیکاسیون ندارد مگر در صورت خونریزی فعال.

*در

HIT(Heparin InducedThrombocytopenia) و TTP تزریق پلاکت می تواند زیانبار باشد.

Henry's Clinical Diagnosis & Laboratory Management By Laboratory Methods. 2007 chapter 35 page:669-684

Complications of plt transfusion

1- Febrile & Allergic plt transfusions

(two most common)

- Group O donor plasma from 6-8 pooled donor

2- Acute hemolysis

(passive isoagglutinins)

- Plasma compatible donor prevents such reactions ; espicially important in neonate young children & Adult with multiple transfusion each day

3- Volume overload (Plasma -reducted plt units) or volume reduction technique

- ***4- Immunization to Rh (D)***
- ***5- Thrombosis in TTP***
- ***6- Bacterial contamination***

(10% ; 2/1000)

- ***Endotoxic shock in gram negative***
- ***Transfusion - Associated sepsis***
- ***Chills fever Hypotension & hypoxia***
- ***Shortening the storage shelf life***
- ***Especial care for neutropenic pts***

Systemic reactions to Plt transfusions

- **Acute –Rx: 2% 1/3 reactions in the first transfusion**
- **Rash , wheezing , fever , chills , dyspnea , urticaria & hypotension .**
- **Cytokine generation during the in vitro storage**

  (TNF, IL-1, 6 & 8*).
- **Transfusion reaction x4 with platelet , older & higher WBC contaminated**

ABO group selection for RBC Transfusion

Recipient ABO Group		Component	ABO Group	
	1st Choice	2nd Choice	3rd Choice	4thChoice
A	A	O	None	None
B	B	O	None	None
AB	AB	A	B	O
O	O	None	None	None
Oh (Bombay Group)	Oh	None	None	None

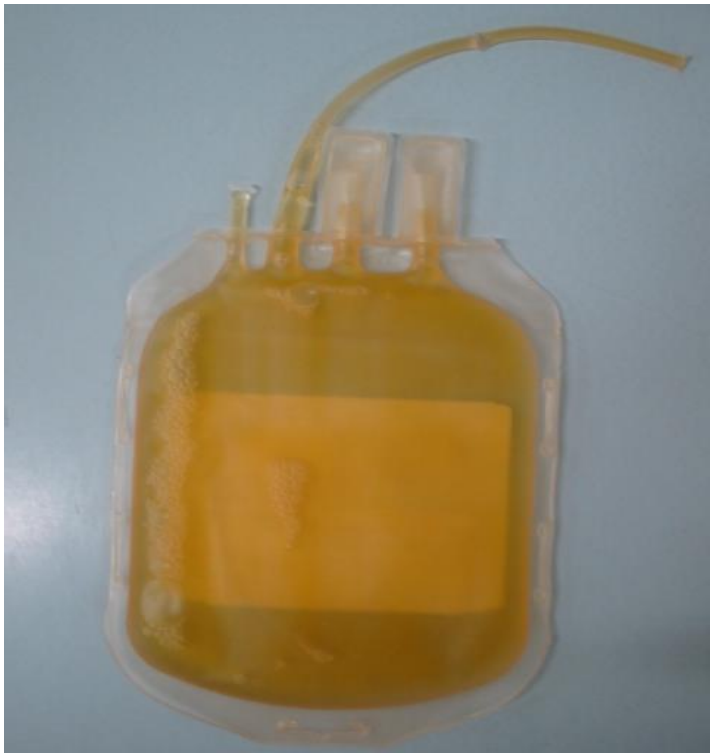
group selection for Plasma/FFP Transfusio

Recipient ABO		Component	ABO	
	1st Choice	2nd Choice	3rd Choice	4thChoice
A	A	AB	None	None
B	B	AB	None	None
AB	AB	None	None	None
O	O	AB	A	B

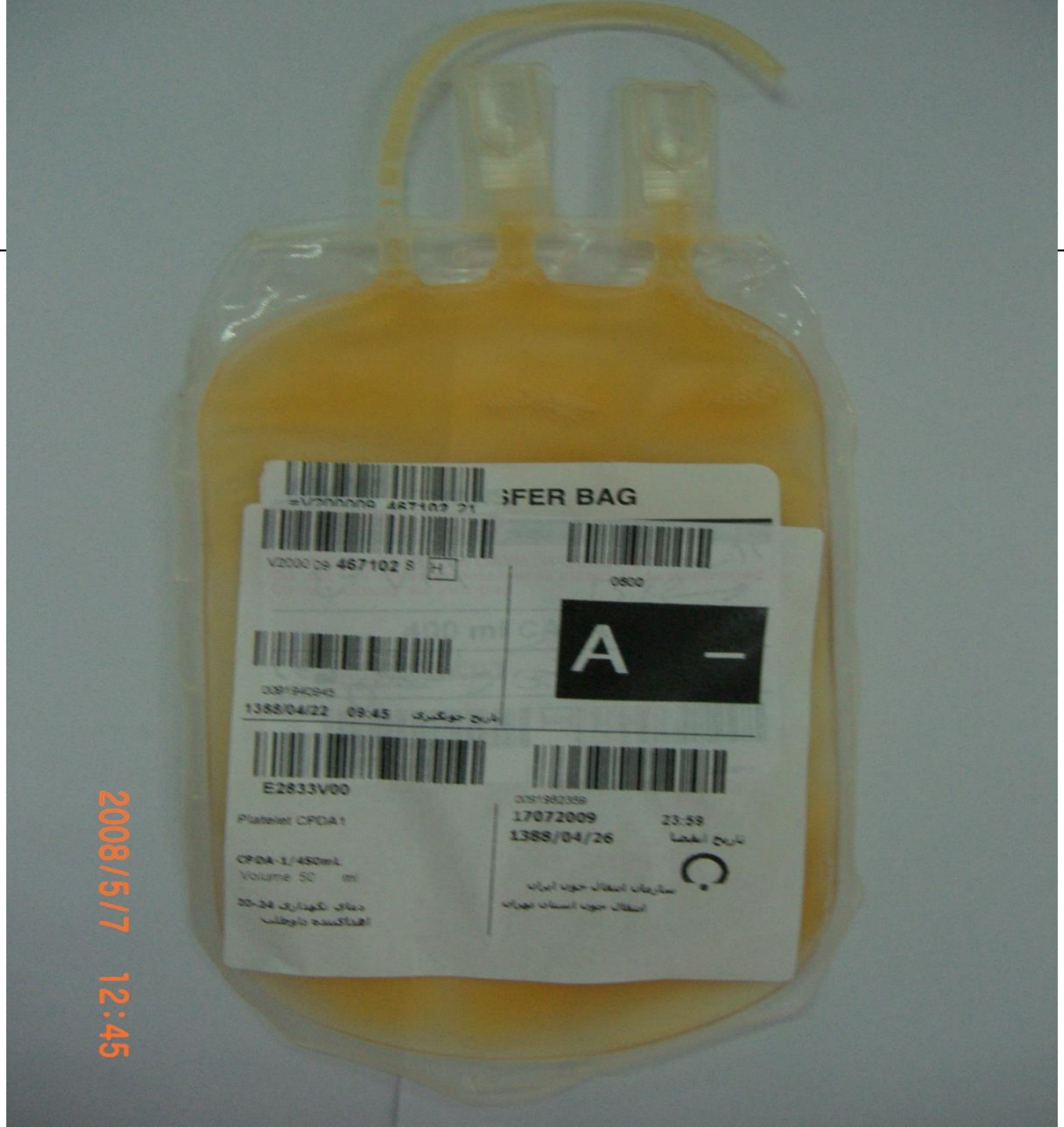
ABO group selection for Platelet Transfusion

Recipient ABO		Component	ABO	
	1st Choice	2nd Choice	3rd Choice	4thChoice
A	A	AB	B	O
B	B	AB	A	O
AB	AB	A	B	O
O	O	A	B	AB

Random Donor Platelet



Volume 50 – 70 ml


SFER BAG
A –
Platelet CPDA1
CPDA-1/450mL
Volume 50 ml
17072009
1388/04/26
1388/04/22 09:45
E2833V00
2008/5/7 12:45

Single Donor Platelet

Volume ~ 300 ml

دستورالعملهاي سازگاري ABO& Rh

گروه خون بيمار	گلبول قرمز سازگار	فرآورده پلاسمايي سازگار
A	A,O	A,AB
B	B,O	B,AB
AB	A,B,AB,O	AB
O	O	A,B,AB,O
Rh- POSITIVE	Rh-POSITIVE, Rh-NEGATIVE	N/A
Rh-NEGATIVE	Rh-NEGATIVE*	N/A

Handbook of Transfusion Medicine. D.Hillyer. 2001

Dosage of plt transfusion

-Many blood centers now report mean contents 20-40% above required minimum (5.5×10^{10}) plt/unit from WB

-*Fewer units need*

-*Acceptance of lower plt count*

-*Progressive reduction in standard dose*

10→8→6→ even 4 units

-*Platelet – Apheresis*

3×10^{11}/unit with early instruments

-*Corrected count increment (CCI)*

CCI (10min-1Hr) < 7500 **CCI (24Hr) < 4500**

Immune Refractoriness **Non-Immune**

TABLE 20-5. Determination of Platelet Response

Corrected count increment (CCI)

$$CCI = (CI \times BSA)/\text{unit content} (\times 10^{-11})$$

Platelet recovery

$$\text{Platelet recovery (\%)} = \frac{CI \times (1000\ \mu L/mL) \times \text{blood volume in mL} \times 100}{\text{unit content}}$$

Sample calculations

Patient mass = 80 kg: blood volume = 80 kg × 75 mL/kg = 6000 mL

Patient body surface area: 2.0 m^2 (determined from a table or nomogram)

Pretransfusion platelet count:	5000/μL	→ CI = 20,000/μL
Posttransfusion platelet count:	25,000/μL	

Platelet count in unit:	1.5×10^6/μL	→ Unit content = 4.0×10^{11} platelets
Volume of unit:	267 mL	

$CCI = (20{,}000/\mu L \times 2.0\ m^2)/4.0 = 10{,}000$

Successful transfusion:	≥7500
Refractory patient:	Two or more transfusions with CCI <5000

$\text{Recovery} = (20{,}000/\mu L \times 1000\ \mu L/mL \times 6000\ mL \times 100\%)/(4.0 \times 10^{11}) = 30\%$

Maximum achievable if patient has spleen: 65% to 70%

$$CCI = \frac{\text{Platelet count increment} \times BSA}{\text{Number of platelets transfused } (\times 10^{11})}$$

BSA = body surface area (m^2).

Example:

Pretransfusion platelet count = 8000/μL

Post-transfusion platelet count = 36 000/μL

BSA = 1.5 m^2

Platelet dose = 3.0×10^{11}

$$CCI = \frac{24\,000 \times 1.5}{3} = 12\,000$$

A CCI > 7500 at 1 hour or a CCI > 4500 at 24 hours

-Low-dose prophylactic platelet transfusion

(Half the standard dose): 1.5×10^{11}

-SToP & PLADO studies ;

Hypoproliferative thrombocytopenia secondary to chemotherapy for hematologic malignancies or undergoing either autologous or allogeneic stem cell transplantation were randomly assigned to a prophylactic platelet transfusion dose of 1.1 (low dose), 2.2 (medium dose), or 4.4 x $l0^{11}/m^2$ platelets (high dose).

Not statistically different between bleeding episodes in 1272 pts who received at least one plt transfusion for WHO Grade 2 or higher bleeding

TABLE 19-4. Summary of WHO Bleeding Scale*

WHO Bleeding Grade	Examples
1	Oropharyngeal bleeding ≤30 minutes in 24 hours
	Epistaxis 230 minutes in previous 24 hours
	Petechiae of oral mucosa or skin
	Purpura ≤1 inch in diameter
	Positive stool occult blood test
2	Epistaxis >30 minutes in 24 hours
	Purpura >1 inch in diameter
	Hemoptysis
	Melanotic stool
	Gross/visible hematuria
	Visible blood in body cavity fluid
	Bleeding at invasive sites
3	Bleeding requiring RBC transfusion over routine needs
	Bleeding associated with moderate hemodynamic instability
4	Bleeding associated with severe hemodynamic instability
	CNS bleeding on imaging study
	Fatal bleeding

*Modified from Kaufman et al.[56]

WHO = World Health Organization; RBC = Red Blood Cell; CNS = central nervous system.

Two recent multicenter studies examined transfusion management of massively bleeding trauma

- The **Prospective, Observational, Multicenter, Major Trauma Transfusion (PROMMTT)** study l03 was a prospective observational study of adult trauma patients treated at 1 of 10 civilian trauma centers in the U.S. .
- Study staff performed direct bedside observation as patients were resuscitated.
- **To reduce potential survivor bias**, patients dying within the first 30 minutes of arrival were excluded.
- Patients who received **plasma to RBCs in a 1:1 ratio had significantly better 6-hour survival** than patients receiving a lower ratio of plasma to RBCs.
- However, survival at later time points did not differ significantly.

- A subsequent RCT, called the **Pragmatic Randomized Optimal Platelet and Plasma Ratios (PROPPR) trial,** compared outcomes among **680 adult civilian trauma patients** who were randomly assigned to be **resuscitated using a 1:1 :1 vs 1:1:2 ratio of plasma to platelets to RBCs.**
- The **primary outcomes**, **24-hour & 30-day survival**, did not significantly differ between the study groups.
- Currently, it is common for blood banks to incorporate fixed ratios of blood components **(ie, 1:1:1 or 1:1:2) into their local massive transfusion protocols (MTPs).**
- Although it is difficult to judge the effectiveness of this approach from the published data, it does **improve the speed & simplicity of the initial response.**
- Laboratory based, targeted transfusion of specific components is often used after the patient has stabilized.
- It is important to note that although much of the data on MTPs relates to trauma, in civilian hospitals, **massive transfusions are actually more likely to occur among other patient populations (eg, solid-organ transplant patients & cardiac surgical patients)**