BLOOD TRANSFUSION & CROSS-MATCHING

BY

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LEARNING OBJECTIVES

- To understand the inheritance and significance of the ABO system
- To understand the nature and significance of the Rh blood group system including RhD
- To know the principles involved in the selection of donor blood of suitable ABO and Rh groups for a recipient, and the principles of the cross-match, including the antiglobulin test
- To understand the hazards of blood transfusion
- To know how to investigate a patient suspected of receiving an incompatible transfusion
- To know the basis of blood fractionation and the rationale for the use of specific blood products
- To know the pathogenesis, clinical features and the principles underlying the treatment and prevention of haemolytic disease of the newborn (HDN) due to anti-D

BLOOD DONORS

1. Voluntary donors

   Outdoor donors and recruitment campaigns.

   Hospital staff.

2. Involuntary donors

   Relatives of patients admitted to hospital for elective surgery and normal deliveries.

   Relative of patients who receive emergency blood transfusion (replacement donations).

   Persons applying for driving licenses.

3. Autologous donations

Patients for elective surgery can donate 4 units in one month before surgery (one unit/week).

Acute normovolaemic haemodilution, 2-3 units of blood can be obtained from the patient immediately before surgery (Target haematocrit 25-30%).

Salvage of the blood lost during surgery with special blood salvage devices.

Combination of the above methods.

4. Directed blood donations from close relative of patients on their requests.

AUTOLOGOUS BLOOD TRANSFUSION

- **Predeposited**:

Blood is collected in the weeks prior elective surgery

Haemodilution:

Blood is collected immediately before surgery to be reinfused at the end of the operation

Salvage:

Heavy blood loss during operation is collected to be reinfused

What are the criteria for accepting blood donation?

1. To be eligible to donate blood, a person must be in good health and generally must be at least 16 years of age.
2. Minimum weight requirements may vary among facilities, but generally, donors must weigh at least 110 pounds (50kg).
3. Most blood banks have no upper age limit.
4. All donors must pass the physical and health history examinations given prior to donation.

What are the criteria for accepting blood donation? (Continue)

5. Volunteer donors provide nearly all blood used for transfusion in KSA.
6. The donor's body replenishes the fluid lost from donation in 24 hours. It may take up to two months to replace the lost red blood cells.
7. Whole blood can be donated once every eight weeks (56 days).
8. Two units of red blood cells can be donated at one time, using a process known as red cell apheresis. This type of donation can be made every 16 weeks.

4. Who should not donate blood?

Anyone who has ever used intravenous drugs (illegal IV drugs).

Men who have had sexual contact with other men since 1977.

Anyone who has ever received clotting factor concentrates.

Anyone with a positive test for HIV (AIDS virus)

Men and women who have engaged in sex for money or drugs.

Anyone who has had hepatitis like B, C etc.

Who should not donate blood? (Continued)

Anyone who has ever used intravenous drugs (illegal IV drugs).

Men who have had sexual contact with other men since 1977.

Anyone who has ever received clotting factor concentrates.

Anyone with a positive test for HIV (AIDS virus)

Men and women who have engaged in sex for money or drugs since 1977.

Anyone who has had hepatitis since his or her eleventh birthday.

Donors temporary deferral

Active disease under treatment:

Cold, flu, T.B., Syphilis, infections, curable disease of heart, lungs, kidneys, liver, GIT, treatment with antibiotics.

For Three Years:

Immigrant coming from malarial endemic area, one who had diagnosis of malaria.

For One Year:

Hepatitis B vaccine.

Rabies vaccine.

History of close contact with viral hepatitis patient.

Tattoo patient.

Contact with a prostitute or other persons with high risk for AIDS.

Donors Temporary Deferral (continued)

For Two Months:

Recent blood donation.

For Six weeks:

Following delivery.

For One Month:

Rubella vaccination (German measles).

Blood bank
KING SAUD UNIVERSITY HOSPITALS
بنك الدم - المستشفيات الجامعية - جامعة الملك سعود

Confidential

DONOR HEALTH HISTORY QUESTIONNAIRE
REGESTRATION

Donor No.:	Date:	Unit No. :

Donor Name أسم المتبرع

الأسم الاول:	الأب:	الجد:	العائلة:
Family Name:	Middle Name:	Father Name:	First Name:

Date of last donation: Place of last donation:

Result of last donation:

Gender: Male ☐ Female ☐ Nationality:

Date of birth: / / Age:.....years

Passport ☐ Iqama ☐ ID ☐ No.: | | | | | | | | | | |

Address:

Mobile: Phone:

E- Mail :

Donation Reson سبب التبرع

Volunteer ☐ متطوع Therapeutic ☐ علاجي Repalement ☐ موجه لمريض

Autologous ☐ ذاتي Driving License ☐ استخراج رخصة

Patient File No.: رقم ملف المريض:

Type of donation نوع التبرع

Whole blood ☐ وحدة كاملة Plasma Aphaeresis ☐ بلازما

Automated Double R. B. C. ☐ وحدة مزدوجة من خلايا الدم الحمراء Platelets Aphaeresis ☐ صفائح

THIS SECTION TO BE COMPLETED BY FRIST- TIME DONORS ONLY

HAVE YOU EVER RECEIVED BLOOD ? ☐ YES ☐ NO ☐ UNKNON

CURRENT OCCUPATION :

HOW WOULD YOU PREFEER TO BE REMINDED TO DONATE BLOOD ? ☐ Letter ☐ Mobile ☐ Email ☐ Fax ☐ Phone ☐ SMS ☐ None

Receptionist:	Signature:

HEALTH Check QUESTIONNAIRE

Please respond by placing a ✓ in the relevant box. Do not circle.

1. Are you feeling well and healthy today ?	☐ YES ☐ NO
2. Did you eat well in the last 3hours?	☐ YES ☐ NO
3. Did you sleep well? ☐ YES ☐ NO .How many hours did you sleep for the last 24 hours?.....	
4. Are you Currently taking an antibiotic?	☐ YES ☐ NO
5. Are you Currently taking any other medication ? ☐ YES ☐ NO What ?.....	
6.Have you read the educational materials?	☐ YES ☐ NO
7. Since last week have you had any dental surgery ?	☐ YES ☐ NO
8. Have you ever been rejected as a blood donor ? ☐ YES ☐ NO If yes why ?.....	
9. In the past 72 hours Have you taken aspirin or anything that has aspirin in it?	☐ YES ☐ NO
# In the past 8 weeks have you:	
10. Donated blood?	☐ YES ☐ NO
11. Had contact with someone who had a smallpox vaccination?	☐ YES ☐ NO
# In the past 16 weeks:	
12. Have you donated a double unit of red cells using an apheresis machine?	☐ YES ☐ NO
13. Had any vaccinations or other shots?	☐ YES ☐ NO
# In the past 12 months have you:	
14. have you had surgery or sever illness ?	☐ YES ☐ NO
15. have you or your spouse received blood or blood components?	☐ YES ☐ NO
16. Had a transplant such as organ, tissue, or bone marrow?	☐ YES ☐ NO
17. Had an accidental needle-stick?	☐ YES ☐ NO
18. Had sexual contact with anyone who has HIV/AIDS or has had a positive test for the HIV/AIDS virus or hemophilia or has used clotting factor concentrates?	☐ YES ☐ NO
19. Had sexual contact with a person who has hepatitis?	☐ YES ☐ NO
20. Ever been I.V. drug user, or used intranasal cocaine'?	☐ YES ☐ NO
21. Lived with a person who has hepatitis, HIV/AIDS or has had a positive test for the HIV/AIDS ?	☐ YES ☐ NO
22. Had a tattoo, acupuncture, hejama , ear or body piercing?	☐ YES ☐ NO
23. Had or been treated for syphilis or gonorrhea?	☐ YES ☐ NO
24. Been in juvenile detention or prison for more than 72 hours?	☐ YES ☐ NO
25. Been outside the Kingdom of Sauidi Arabia ?	☐ YES ☐ NO
26. been given rabies shots ?	☐ YES ☐ NO
27. had any medical investigations or tests (including endoscopy)?	☐ YES ☐ NO

# From 1980 till now,		
28. Did you spend time that adds up to six (6) months or more in the United Kingdom?	☐ YES	☐ NO
29. Spend time that adds up to five (5) years or more in Europe?	☐ YES	☐ NO
30. Receive a blood transfusion in the United Kingdom or France?	☐ YES	☐ NO
# Have you EVER:		
31. Had a positive test for the HIV/AIDS virus?	☐ YES	☐ NO
32. Used needles to take drugs, steroids, or anything not prescribed by your doctor?	☐ YES	☐ NO
33. Received a dura mater (or brain covering) graft?	☐ YES	☐ NO
34. Had a graft such as bone , skin or cornea?	☐ YES	☐ NO
35. Come into contact with someone else's blood?	☐ YES	☐ NO
36. Had jaundice or hepatitis?	☐ YES	☐ NO
37. Had a serious illness or seen a doctor about your heart?	☐ YES	☐ NO
38. Had any type of cancer, including leukemia?	☐ YES	☐ NO
39. Had growth hormone , Or injected with beef insulin ?	☐ YES	☐ NO
40. Any of your relatives had Creutzfeldt-Jakob disease [Cow – madness disease]?	☐ YES	☐ NO

42 Do you know that, if you have AIDS virus. you can transmit it even with negative AIDS test?

43 If you suffer or have you suffered from one of these diseases please respond by placing a ✓ in the relevant box:

☐ Severe loss of weight

☐ Syphilis	☐ Prolonged fever or diarrhea	☐ Asthma	☐ Gonorrhea
☐ Enlarged glands	☐ Allergy	☐ Malaria	☐ Hepatitis
☐ Unexplained weight loss	☐ Skin disease	☐ Jaundice	☐ Brucellosis
☐ Heart Disease	☐ Diabetes	☐ Leishmaniasis	☐ Blood disease
☐ Bleeding abnormalities	☐ Chaga's disease	☐ AIDS	☐ Kidney disease
☐ Epilepsy	☐ Lung disease	☐ Stroke	☐ Others:.....

44. To be answered by women only.

☐ during the past 6 weeks have you been pregnant or ☐ delivered a baby or ☐ are menstruating now?

I have today read, understood and answered accurately all the above questions to the best of my knowledge. I hereby grant permission to the blood bank of University Hospitals to draw one unit of whole blood or to perform apheresis procedure . I agree that my blood donation will be tested for diseases and to be used for the benefit of patients as blood bank wishes.

Donor Name:	Donor Signature:	Date: / /

Do you wish to speak in confidence to a doctor or a nurse? ☐ YES ☐ NO

Thank you for coming to give blood today

MEDICAL EXAMIANTION by blood bank staff

General Condition:	Donor Height cm	Donor Weight Kg
Temp.: °C	Pulse : /min.	*B.P m.m Hg
☐ Accept ☐ Defer	☐ Permenant	☐ Temporary
Cause of rejection		
Recall Date:		

Remarks

Physician Name:	Signature:	Date: / /

CHECK UP SCREENING

Capillary *Hb. level g/dl	☐ Male	☐ Female
Blood group if applicable:		

☐ Accept	☐ Reject

Technician Name:	Signature:	Date: / /

BLOOD COLLECTION

☐ Complete	☐ Discontinued Product	☐ Adverse reactions
Type of reaction		
*V.P. Time start: ☐ AM ☐ PM	- *V.P. Time end:	☐ AM ☐ PM,
Unit Volume:		

Blood Bag Lot No.:	Expired Date:

Technician Name:	Signature:	Date: / /

Key: * B.P. = Blood Pressure. * Hb. = Hemoglobin. * V.P. = Venipuncture.

(سري)

Blood bank
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استمارة التبرع بالدم
تسجيل المتبرع

Donor No.:	Date:	Unit No. :

Donor Name اسم المتبرع

First Name:	Father Name:	Middle Name:	Family Name:
الاسم الأول:	الأب:	الجد:	العائلة:

تاريخ آخر تبرع — مكان التبرع

نتيجة آخر تبرع

الجنس ☐ ذكر ☐ أنثى — الجنسية

تاريخ الميلاد — محل الميلاد — العمر سنة

☐ جواز ☐ بطاقة أحوال ☐ إقامة — رقم

العنوان

جوال — رقم الهاتف

البريد الالكتروني

Reson of Donation سبب التبرع

موجه لمريض ☐ Replacement — علاجي ☐ Therapeutic — متطوع ☐ Volunteer

ذاتي ☐ Autologous — استخراج رخصة ☐ Driving License

رقم ملف المريض: — Patient File No.:

Type of donation نوع التبرع

صفائح ☐ Platelets Aphaeresis — وحدة كاملة ☐ Whole blood

بلازما ☐ Plasma Aphaeresis — وحدة مزدوجة من خلايا الدم الحمراء ☐ Automated Double R. B. C.

تملأ هذه البيانات في أول زيارة للتبرع بالدم فقط

هل سبق أن نقل لك دم طوال حياتك — ☐ نعم ☐ لا ☐ لا أعرف

الوظيفة الحالية

ما هي الوسيلة التي تفضلها لتذكيرك للتبرع بالدم ؟ ☐ خطاب ☐ الجوال ☐ البريد الإلكتروني

☐ فاكس ☐ التليفون ☐ رسالة SMS ☐ لاشيء

موظف الاستقبال	التوقيع

التاريخ الصحي للمتبرع

ضع علامة ✓ في المربع المناسب لإجابتك

١. هل تشعر بأنك بصحة جيدة اليوم؟	☐ نعم ☐ لا
٢. هل تناولت أي مأكولات خلال الثلاث الساعات السابقة؟	☐ نعم ☐ لا
٣. هل أخذت قسطاً وافراً من النوم ؟ ☐ نعم ☐ لا كم ساعة نمت خلال ٢٤ ساعة الماضية؟.....	
٤. هل تأخذ حاليا أي مضادات حيوية ؟	☐ نعم ☐ لا
٥. هل تأخذ أي علاج الآن؟ ☐ نعم ☐ لا إذا كان نعم فماهو ؟	
٦. هل قرأت المطويات التعليمية (النشرات) التعليمة؟	☐ نعم ☐ لا
٧. هل أجريت لك جراحة بالأسنان خلال الأسبوع الماضي؟	☐ نعم ☐ لا
٨. هل سبق رفضك كمتبرع بالدم؟ ☐ نعم ☐ لا لماذا؟	
٩. خلال الـ ٧٢ ساعة السابقة للتبرع هل أخذت أسبرين أو أي دواء يحتوي على أسبرين؟	☐ نعم ☐ لا
# خلال الـ ٨ أسابيع (شهرين) السابقة للتبرع:	
١٠. هل تبرعت بالدم؟	☐ نعم ☐ لا
١١. هل خالطت شخصاً قد أخذ تطعيم الجدري؟	☐ نعم ☐ لا
# خلال الـ ١٦ أسبوعاً (٤أشهر تقريبا) السابقة للتبرع:	
١٢. هل تبرعت بوحدة دم مزدوجة بأستخدام جهاز فصل الخلايا؟	☐ نعم ☐ لا
١٣. هل أخذت أياً من التطعيمات أو أي نوع من الحقن؟	☐ نعم ☐ لا
# خلال الـ ١٢ شهراً السابقة للتبرع:	
١٤. هل أجريت لك عملية جراحية؟ أو عانيت من مرض شديد؟	☐ نعم ☐ لا
١٥. هل نقل لك دم أو أي من مشتقاته؟ (زوجك/زوجتك)؟	☐ نعم ☐ لا
١٦. هل لامست دم شخص آخر؟	☐ نعم ☐ لا
١٧. هل سبق وخزك بإبرة عن طريق الخطأ؟	☐ نعم ☐ لا
١٨. هل (زوجتك/زوجك) مريض بالهيموفيليا أو(تأخذ/يأخذ) عوامل التجلط؟	☐ نعم ☐ لا
١٩. هل كانت هناك أيه علاقة جنسية غير شرعية؟ أومع مريض بالالتهاب الكبدي؟	☐ نعم ☐ لا
٢٠. هل كنت تتناول المخدرات عن طريق الحقن أو تستنشق كوكايين؟	☐ نعم ☐ لا
٢١. هل خالطت شخصاً مصاباً بالالتهاب الكبدى الفيروسي (باء) أو (سي) ؟	☐ نعم ☐ لا
٢٢. هل خالطت شخصاً مصاباً بمرض الإيدز؟	☐ نعم ☐ لا
٢٣. هل عملت وشماً أو حجامة أوعولجت بالإبر الصينية أو أجريت ثقباً للأذن أو ثقباً للجلد؟	☐ نعم ☐ لا
٢٤. هل عولجت أو تعالج حاليا من السيلان أو الزهري؟	☐ نعم ☐ لا
٢٥. هل كنت مسجوناً لأكثر من ٧٢ ساعة؟	☐ نعم ☐ لا
٢٦. هل سافرت خارج المملكة العربية السعودية خلال العام الماضي؟ ☐ نعم ☐ لا إذا كانت الاجابة نعم ..أين ؟ ومتى ؟.....	
٢٧. هل أخذت علاجاً بالحقن لمرض الكلب خلال العام الماضي؟	☐ نعم ☐ لا
٢٨. هل أجريت أي فحوصات طبية (بما في ذلك المناظير) ؟	☐ نعم ☐ لا

# المدة من ١٩٨٠م وحتى الآن:		
٢٩. هل أقمت في إنجلترا لمدة٦ أشهر أو أكثر؟	☐ نعم	☐ لا
٣٠. هل أمضيت فترة أكثر من ٥ سنوات في أوروبا؟	☐ نعم	☐ لا
٣١. هل أخذت دماً أو أحد مشتقاته في بريطانيا (المملكة المتحدة) أو فرنسا ؟أو في أي بلد خارج المملكة؟	☐ نعم	☐ لا
# هل كان عندك قبل ذلك (طوال حياتك):		
٣٢. نتيجة إيجابية لمرض نقص المناعة (الإيدز)؟	☐ نعم	☐ لا
٣٣. هل أجريت لك عملية جراحية بالمخ لزراعة غشاء الديورا؟	☐ نعم	☐ لا
٣٤. هل زرعت لك أعضاء أو أنسجة أو نخاع ؟	☐ نعم	☐ لا
٣٥. هل أجرى لك ترقيع للجلد أو للعظام أو للقرنية؟	☐ نعم	☐ لا
٣٦. هل كان لديك يرقان (صفراء) أو إلتهاب كبدي؟	☐ نعم	☐ لا
٣٧. هل كان لديك مرض شديد أجريت فحصاً لقلبك بواسطة طبيب؟	☐ نعم	☐ لا
٣٨. هل أصبت بأي سرطان بما في ذلك اللوكيميا؟	☐ نعم	☐ لا
٣٩. هل أخذت حقن أنسولين بقري ؟ أو هرمون النمو؟	☐ نعم	☐ لا
٤٠. هل أصبت أو أحد أفراد أسرتك بمرض جنون البقر؟	☐ نعم	☐ لا

٤١. هل تعلم لو انك تحمل فيروس الإيدز، فانك ستنقله للآخرين عن طريق الدم حتى لو كانت نتيجة فحص الايدز سلبية؟

٤٢. هل تعاني حاليا أو عانيت في الماضي من أحد الأمراض التالية؟

ضع علامة ✓ إذا كان لديك هذا المرض:

☐ نقص شديد في الوزن بدون أسباب	☐ إرتفاع بالحرارة أو إسهال مستمر لفترة طويلة	☐ الإيدز	☐ التهاب كبد فيروسي
☐ مرض السكري	☐ تضخم بالغدد	☐ لشما نيا	☐ أمراض بالدم	☐ أمراض النزف
☐ جلطة الدماغ أو نزيف بالمخ	☐ مرض بالقلب	☐ مرض بالرئتين	☐ الدرن	☐ ربو شعبي
☐ سيلان ☐ الصرع	☐ مرض بالكلى	☐ حساسية	☐ الملا ريا	☐ حمى مالطية
☐ يرقان ☐ مرض شاجاز	☐ مرض جلدي (صدفية، بهاق، حزاز، أكزيما .....الخ)			☐ أي أمراض أخرى

٤٣. للإناث: (أ) خلال الستة الأسابيع الأخيرة :

هل كنت حاملاً؟ ☐ نعم ☐ لا أو وضعتي مولودا ؟ ☐ نعم ☐ لا

أوكان هناك إجهاض؟ ☐ نعم ☐ لا

(ب) هل عندك الدورة الشهرية الآن ؟ ☐ نعم ☐ لا

لقد قرأت وفهمت وأجبت بصدق على جميع الأسئلة السابقة بقدر علمي. كما أنني أفوض بنك الدم بالمستشفيات الجامعية بسحب وحدة دم منى (٤٥٠ مل) أو وحدة صفائح دم أو وحدة بلازما أو وحدة كريات دم حمراء ، وإجراء عملية فصل المكونات المختلفة للدم . وأفوض بنك الدم لكي يستخدمة في منفعة المرضى بالطريقة التي يراها مناسبة.

اسم المتبرع:	التوقيع :	التاريخ : / /

شكرا لحضورك للتبرع اليوم

خاص بالعاملين ببنك الدم

General Condition:	Donor Height cm	Donor Weight Kg
Temp.: °C	Pulse : /min.	*B.P m.m Hg
☐ Accept ☐ Defer	☐ Permenant	☐ Temporary
Cause of rejection		
Recall Date:		
Remarks		
Physician Name :	Signature:	Date: / /

CHECK UP SCREENING

Capillary *Hb. level g/dl	☐ Male	☐ Female
Blood group if applicable:		
☐ Accept	☐ Reject	
Technician Name:	Signature:	Date: / /

BLOOD COLLECTION

☐ Complete	☐ Discontinued Product	☐ Adverse reactions
Type of reaction		
*V.P. Time start: ☐ AM ☐ PM	- *V.P. Time end:	☐ AM ☐ PM,
Unit Volume:		
Blood Bag Lot No.:	Expired Date:	
Technician Name:	Signature:	Date: / /

Key: * B.P. = Blood Pressure. * Hb. = Hemoglobin. * V.P. = Venipuncture.

مطابع جامعة الملك سعود

Those who may be deferred permanently include:

* Anyone who has ever used intravenous drugs (illegal IV drugs).
* Men who have had sexual contact with other men.
* Anyone who has ever received clotting factor concentrates.
* Anyone with a positive test for HIV (AIDS virus)
* Men and women who have engaged in sex for money or drugs.
* Anyone who has had hepatitis since his or her eleventh birthday.
* Anyone who has had babesiosis or Chagas disease.
* Anyone who has had West Nile virus infection
* Anyone who has had Zika virus infection
* Anyone who has had any of the other new virus infections

Those who may be deferred permanently include (continue…):

* Anyone who has taken Tegison for psoriasis.
* Anyone who has risk factors for Crueutzfeldt-Jakob disease (CJD) or who has an immediate family member with CJD.
* Anyone who has risk factors for vCJD.
* Anyone who spent three months or more in the United Kingdom from 1980 through 1996. (This is applied in USA)
* Anyone who has spent five years in Europe from 1980 to the present. (This is applied in USA).

Medication deferral list

If the donor now taking or if he has EVER taken any of these medications:

- **Proscar© (finasteride) -** usually given for prostate gland enlargement.
- **Avodart© (dutasteride) -** usually given for prostate enlargement.
- **Propecia© (finasteride) -** usually given for baldness.
- **Accutane© (Amnesteem, Claravis, Sotret, isotretinoin) -** usually given for severe acne.
- **Soriatane© (acitretin) -** usually given for severe psoriasis.
- **Tegison© (etretinate) -** usually given for severe psoriasis.

Medication deferral list (Continued)

If the donor now taking or if he has *EVER* taken any of these medications:

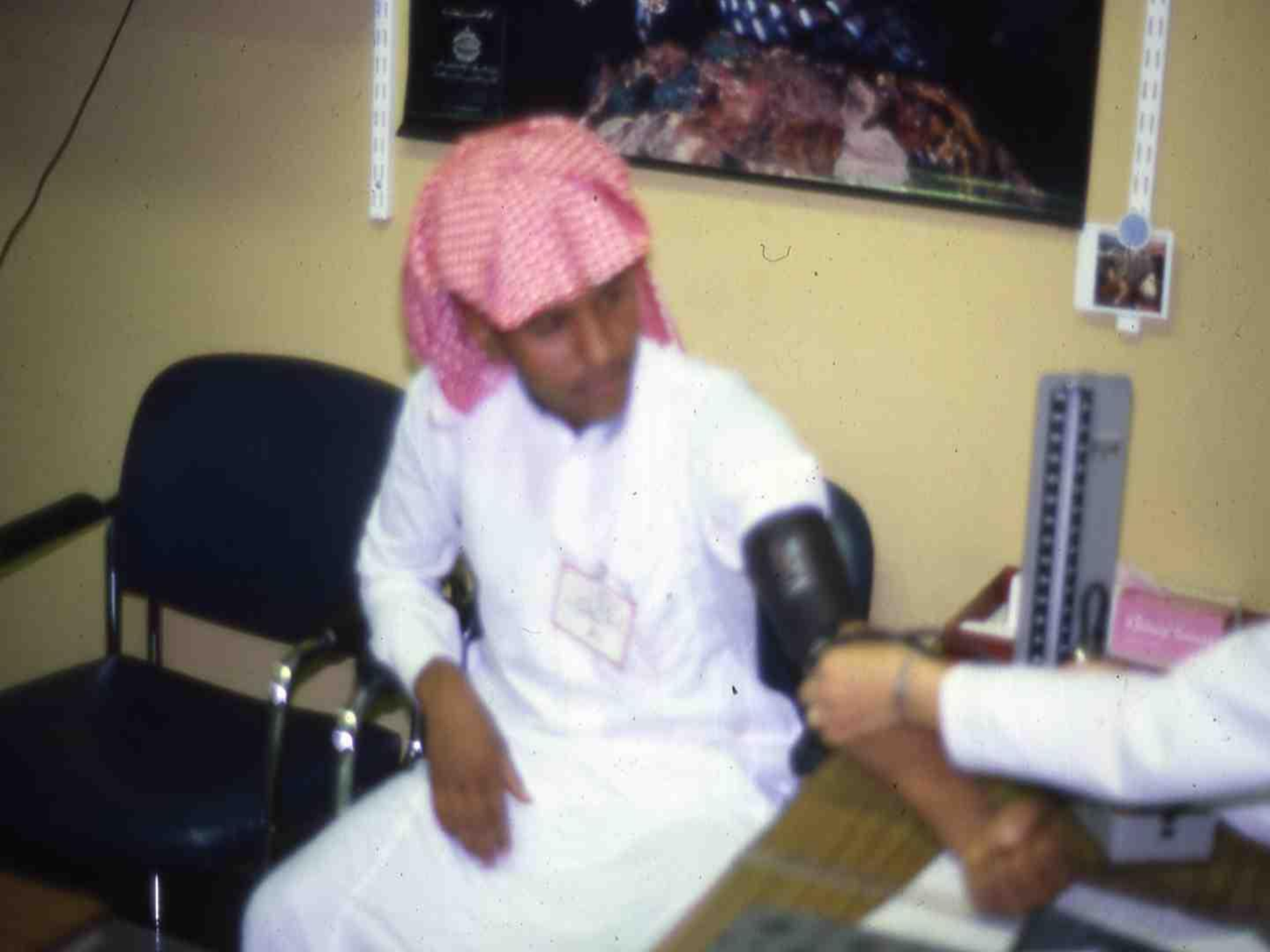
- **Growth Hormone from Human Pituitary Glands -** used usually for children with delayed or impaired growth.

- **Insulin from Cows (Bovine, or Beef, Insulin) -** used to treat diabetes.

- **Hepatitis B Immune Globulin -** given following an exposure to hepatitis B.

  NOTE: This is different from the hepatitis B vaccine which is a series of 3 injections given over a 6 month period to prevent future infection from exposures to hepatitis B.

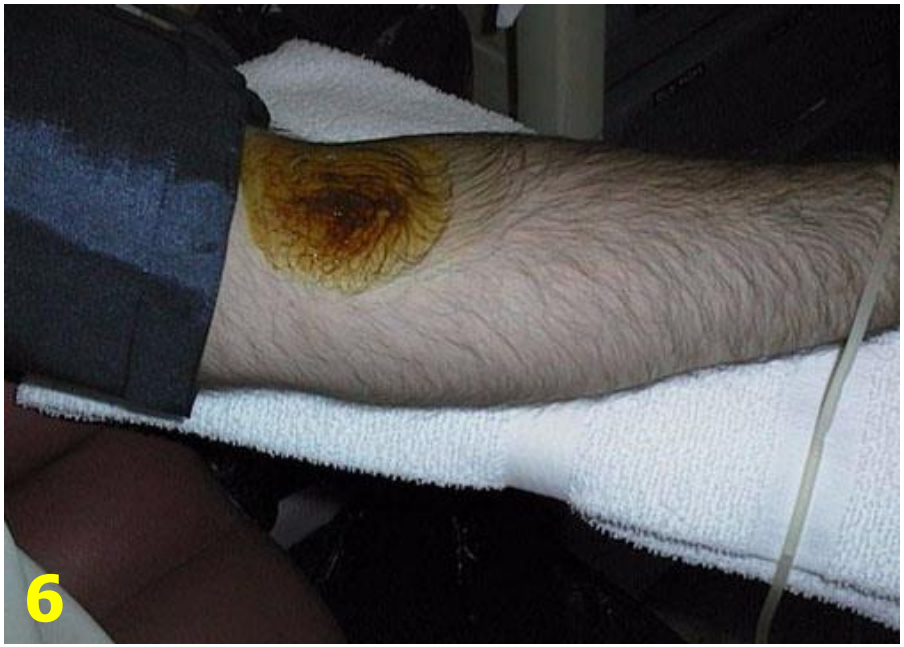
- **Unlicensed Vaccine -** usually associated with a research protocol.




LB 1002

Blood Donation


5


6


7


8


9


10


11


12


STERILE GAUZE SWABS

ACD - A (NIH - A) SOLUTION

Trisodium Citrate (Dihydrate)	2.2 g
Citric Acid (Monohydrate)	0.8 g
Dextrose	2.5 g
Water to	100 ml

67.5 ml of this solution (pH 5.0 – 5.1) are mixed with 450 ml of Blood

Store Red Blood Cells 21 days at 1 – 6 ^{0} C

CITRATE – PHOSPHATE – DEXTROSE (CPD)

Trisodium Citrate (Dihydrate)	26.3 g
Citric Acid (Monohydrate)	3.27 g
Sodium Dihydrogen Phosphate (Monohydrate)	2.22 g
Dextrose	25.5 g
Water to	1000 ml

63 ml of this solution (pH 5.0 – 5.1) are mixed with 450 ml of Blood

Store Red Blood Cells for 28 days at 1 – 6 ^{0} C

Store Platelets for 3days at 20 – 24 ^{0} C

Anticoagulant Citrate Phosphate Dextrose (CPDA-1) Red Blood Cells

63ml Anticoagulant Citrate Phosphate Dextrose Adenine Solution USP for collection of 450ml of blood

Each 63ml contains:

- 188 mg Citric Acid (anhydrous) USP
- 1.66 g Sodium Citrate (anhydrate) USP
- 140 mg Monobasic Sodium Phosphate (monohydrate) USP
- 2.01 g Dextrose (monohydrate) USP
- 17.3 mg Adenine USP

Store Red Blood Cells 35 days at 1 – 6 ^{0} C

Store Platelets 5 days at 20 – 24 ^{0} C

Optisol® AS – 5
Red Cell Preservative Solution

100 ml containing:

- 877 mg Sodium Chloride USP
- 900 mg Dextrose (monohydrate) USP
- 525 mg Mannitol USP
- 30 mg Adenine USP

Contains 15.0 mEq Sodium

Caution: Add Optisol® Solution to Red Blood Cells within 72 hours after Blood Collection

Store Red Blood Cells 42 days at 1 – 6 ^{0} C

Anticoagulant Citrate Phosphate Dextrose (CPDA-2)
Plus Optisol ® for RBCs

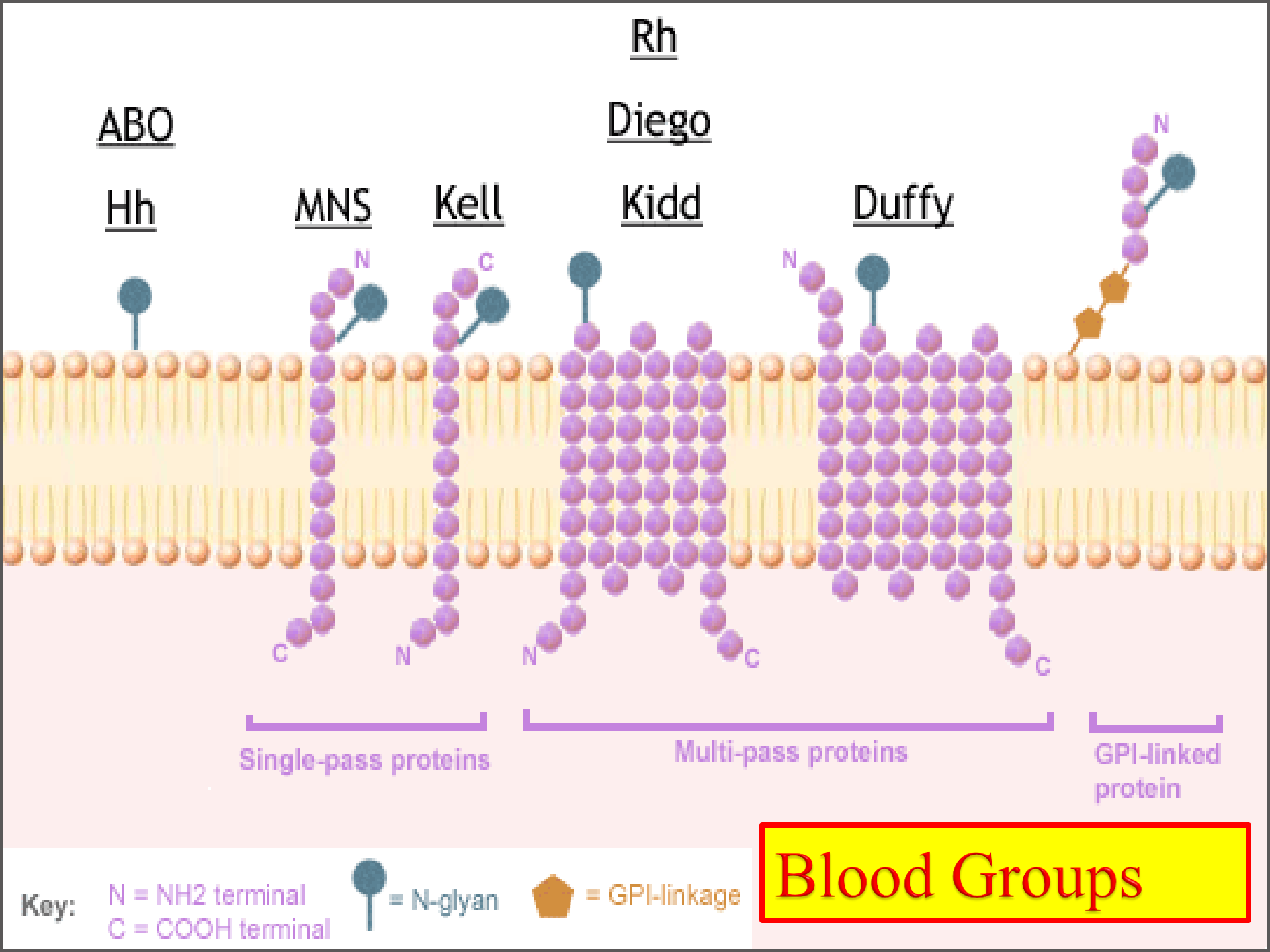
63ml Anticoagulant Citrate Phosphate Dextrose Solution USP for collection of 450ml of blood

Each 63ml contains:

- 188 mg Citric Acid (anhydrous) USP
- 1.66 g Sodium Citrate (anhydrate) USP
- 140 mg Monobasic Sodium Phosphate (monohydrate) USP
- 1.61 g Dextrose (monohydrate) USP
- 15 mEq Sodium Added
- 30 mg Adenine USP

Store Red Blood Cells 42 days at 1 – 6 ^{0} C

Store Platelets 5 days at 20 – 24 ^{0} C

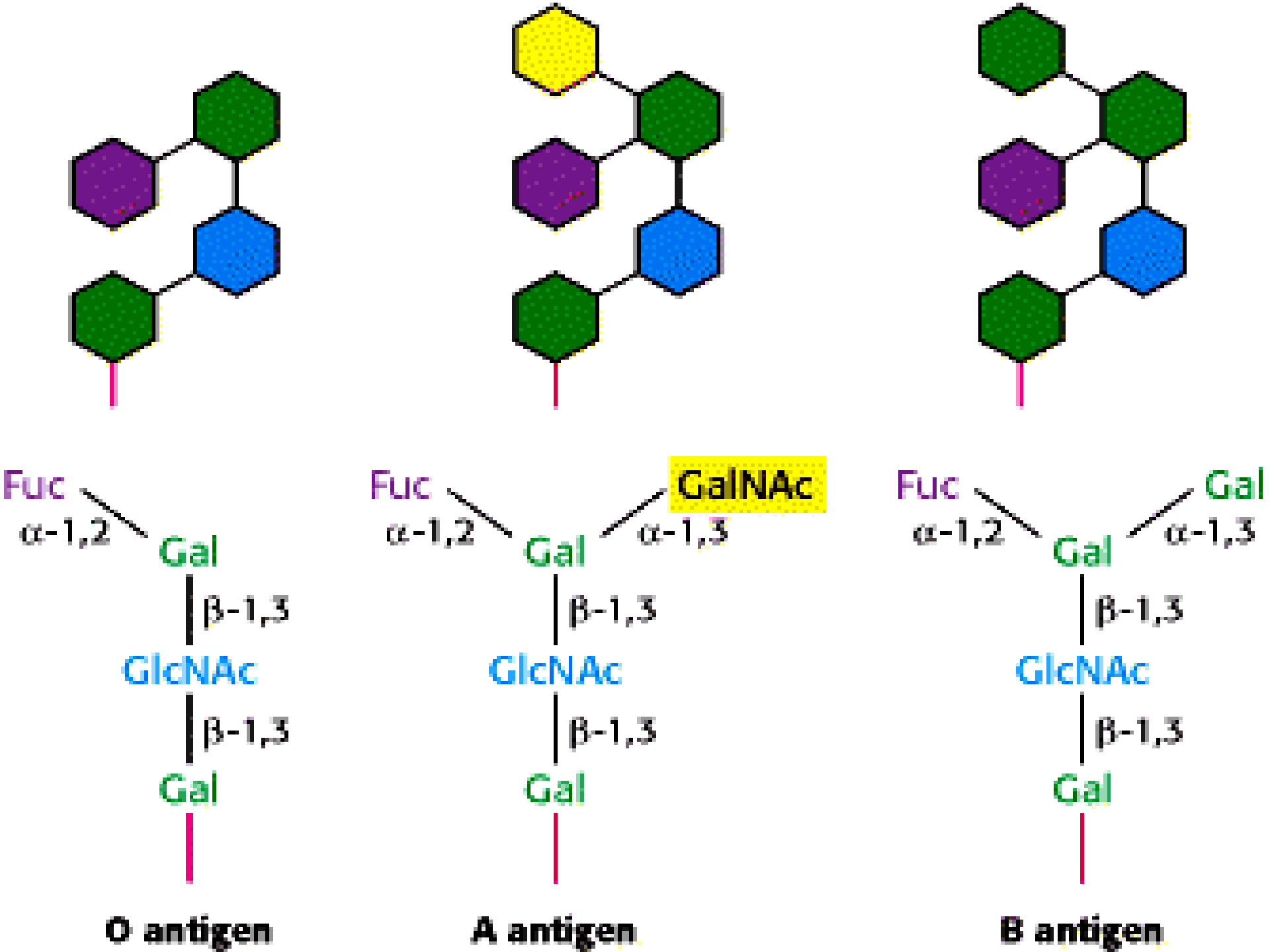

Rh
ABO
Diego
Hh
MNS
Kell
Kidd
Duffy
N
C
C
N
N
C
N
C
N
C
Single-pass proteins
Multi-pass proteins
GPI-linked protein
Key:
N = NH2 terminal
C = COOH terminal
= N-glyan
= GPI-linkage
Blood Groups

ABO system

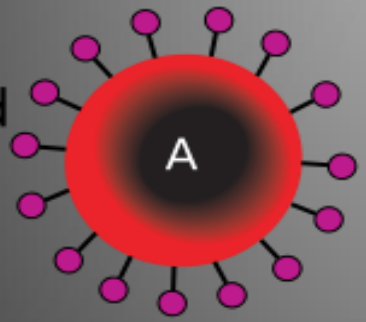
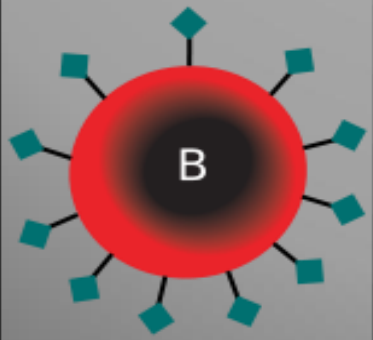
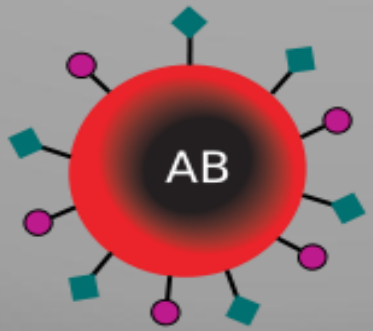
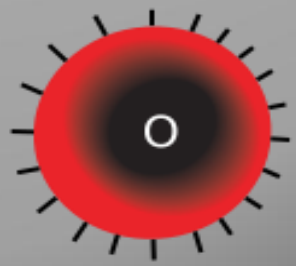
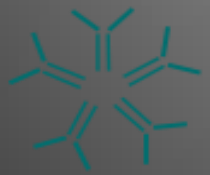
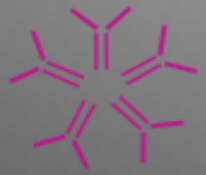
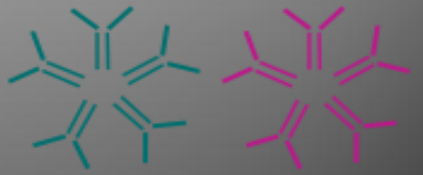
- Practically all red cells have the H antigen, a carbohydrate group attached mainly to proteins on the cell membrane.
- This antigen is the basis for the ABO blood groups.
- The ABO locus is encoded on chromosome 9q, where one of three possible alleles may be found.
- The A allele encodes for a glycosyltransferase, which modifies the H antigen by adding *N*-acetylgalactosamine to it (thus forming the A antigen).
- The B allele of the ABO locus encodes an

cont'd…

- The O allele, by contrast, encodes no functional enzyme at all, such that the H antigen remains unmodified.
- Each patient inherits an allele of the ABO locus on each chromosome 9, there are six possible genotypes, namely AA, AO, BB, BO, AB and OO, and four possible phenotypes: A, AB, B and O.
- Haemolytic reactions will occur immediately in the event of incompatible transfusion, and may be fatal.


Fuc
α-1,2
Gal
β-1,3
GlcNAc
β-1,3
Gal
O antigen
Fuc
α-1,2
Gal
GalNAc
α-1,3
β-1,3
GlcNAc
β-1,3
Gal
A antigen
Fuc
α-1,2
Gal
Gal
α-1,3
β-1,3
GlcNAc
β-1,3
Gal
B antigen

ABO Blood Group

	Group A	Group B	Group AB	Group O
Red blood cell type				
Antibodies present	 Anti-B	 Anti-A	None	 Anti-A and Anti-B
Antigens present	 A antigen	 B antigen	 A and B antigens	None

Other blood group systems

Other blood group antibodies, which are sometimes a problem during blood transfusion, include the following: anti-K (Kell system), anti-Fy^a (Duffy system), anti-Jk^a (Kidd system) and anti-S (part of the MNSs blood group system). These antigens are relatively poorly immunogenic. Their potency in stimulating antibody production is 10-1000 times less than that of RhD. Consequently, these antigens need not be routinely assessed prior to transfusion. Unless for patients who require multiple transfusion.

Significance of Certain Blood Group Antibodies

Blood Group System	Antibody	Relative Frequency in Antibody Screening	Clinical Significance	
			HTR	HDN
ABO	Anti-A	All group B and O	Yes	Yes
	Anti-B	All group A and O	Yes	Yes
Rhesus	Anti-D	Common	Yes	Yes
	Anti-c	Common	Yes	Yes
	Anti-E	Common	Yes	Yes
	Anti-C	Common	Yes	Yes
	Anti-e	Common	Yes	Yes
Kell	Anti-K	Common	Yes	Yes
	Anti-k	Rare	Yes	Yes
Kidd	Anti-Jk^a	Common	Yes	Yes
	Anti-Jk^b	Rare	Yes	Yes
Duffy	Anti-Fy^a	Common	Yes	Yes
	Anti-Fy^a	Rare	Yes	Yes
MN	Anti-M	Common	Occasional	Occasional
	Anti-N	Rare	Rare	Rare
SsU	Anti-S	Uncommon	Yes	Yes
	Anti-s	Rare	Yes	Yes
Lewis	Anti-Le^a	Common	Yes	No
	Anti-Le^b	Uncommon	No	No
P	Anti-P	Uncommon	Rare	No
Ii	Anti-l	Uncommon	No	No

What are the most common blood types?

Distribution may be different for special racial and ethnic groups?

O Rh-positive --- 38 percent.
O Rh-negative --- 7 percent.
A Rh-positive --- 34 percent
A Rh-negative --- 6 percent
B Rh-positive --- 9 percent
B Rh-negative ---2 percent
AB Rh-positive --- 3 percent
AB Rh-negative --- 1 percent

ABO Blood Groups Inheritance

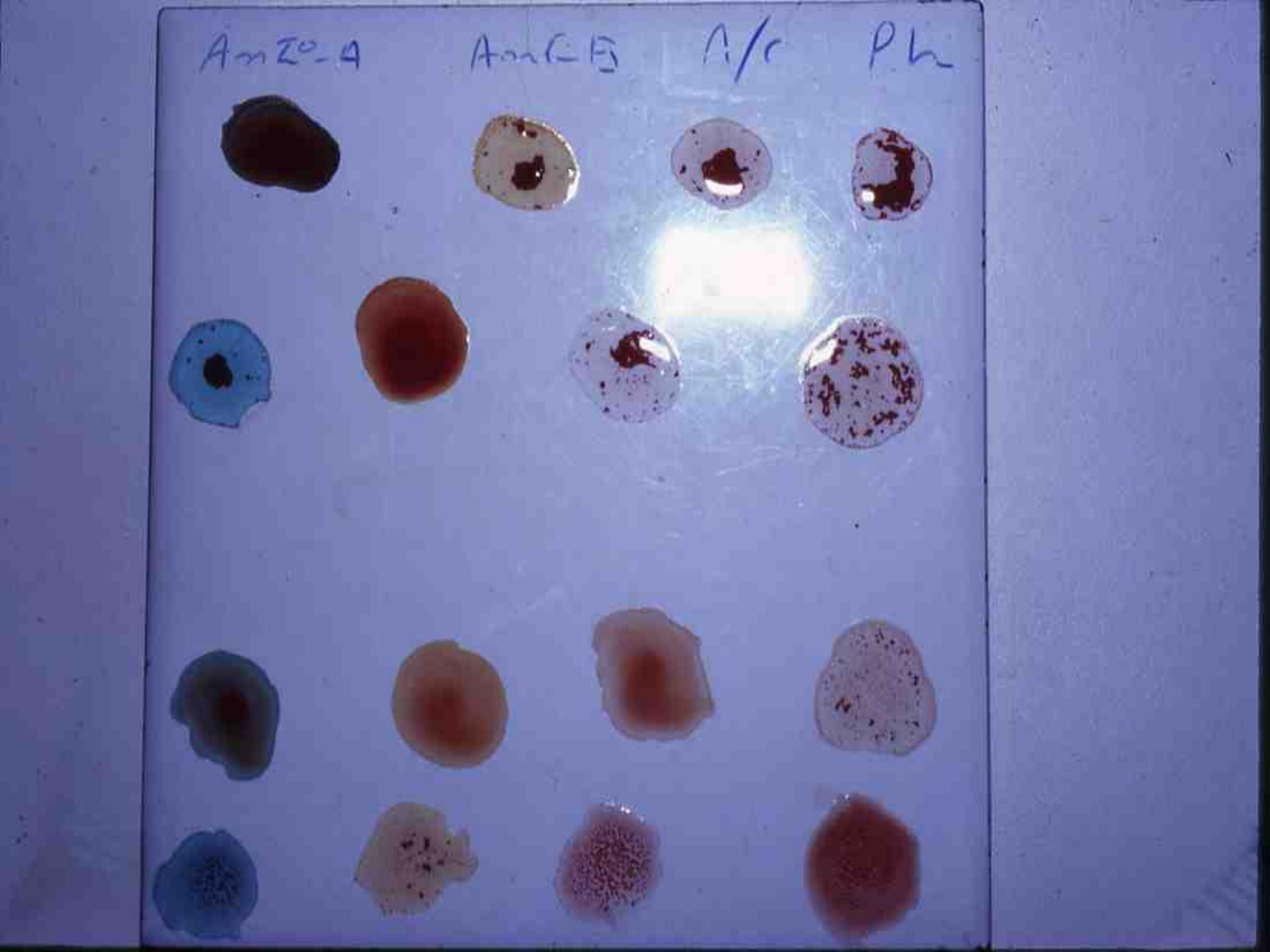
ABO genotype in the offspring		ABO alleles inherited from the mother		
		A	B	O
ABO alleles inherited from the father	A	A	AB	A
	B	AB	B	B
	O	A	B	O

Anti-A

Anti-B

A/C

Rh


A/c
Ph

ABO Blood Groups

Blood group	Antigen(s) present on the red blood cells	Antibodies present in the serum	Genotype(s)
A	A antigen	Anti-B	AA or AO
B	B antigen	Anti-A	BB or BO
AB	A antigen and B antigen	None	AB
O	None	Anti-A and Anti-B	OO

ABO blood group system

Blood group	Subgroup	Antigens on red cells	Antibodies in plasma
A	A_1 A_2	$A + A_1$ A	Anti-B (Anti- A_1)*
B	-	B	Anti-A, Anti- A_1
AB	A_1B A_2B	$A + A_1 + B$ A + B	None (Anti- A_1)*
O	-	(H)†	Anti-A Anti- A_1 Anti-B Anti-A,B†

* Anti- A_1 found in 1-2% of A_2 subjects and 25-30% of A_2B subjects.

* The amount of H antigen is influenced by the ABO group; O cells contain most H and A_1B cells least. Anit-H may be found in occasional A_1 and A_1B subject (see text).

* Crossreactivity with both A and B cells.

BLOOD TRANSFUSION
Blood Compatibility Testing (Crossmatch)

The "Front Type" determines which antigens ("flags") in the ABO blood group system are on the patient's Red Blood Cells as follows:

B antigen only	**Type B**
A and B antigens	**Type AB**
Neither A or B	**Type O**

BLOOD TRANSFUSION

Blood Compatibility Testing (Crossmatch)

The "Back Type" identifies the isohaemagglutinin (Naturally Occurring Antibody) in the patient's serum and should correspond to the antigens found on the Red Blood Cells as follows:

Anti-A	**Type B**
Anti-A and anti-B	**Type O**
Neither anti-A or anti-B	**Type AB**

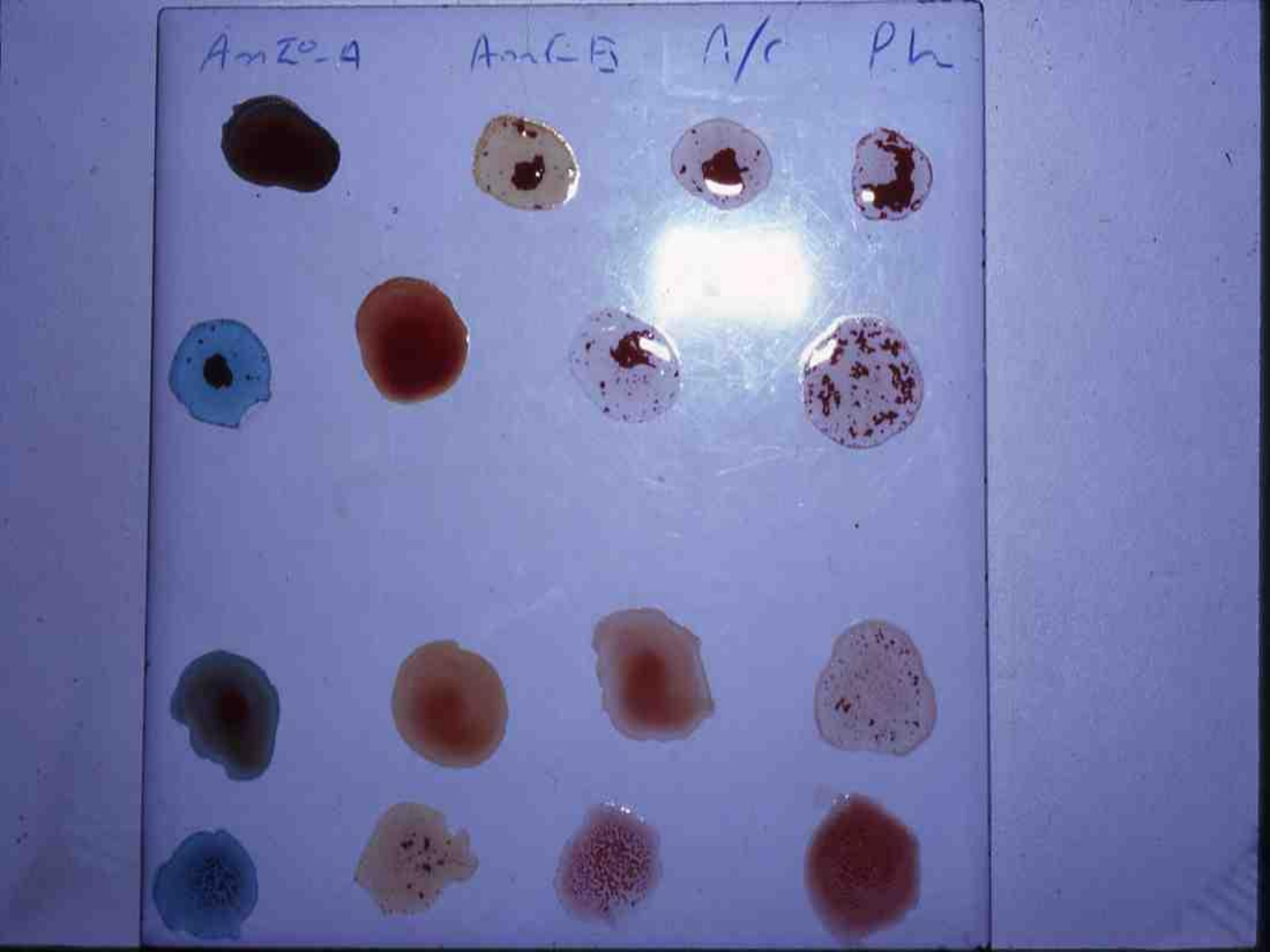
In addition, RBCs are Rh typed and identified as "D" positive or negative

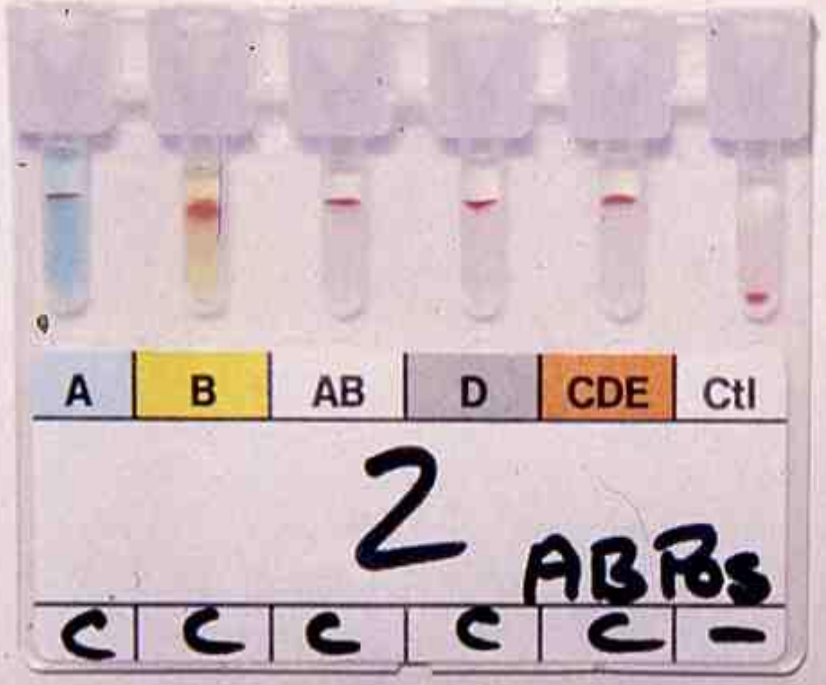
Anti-A

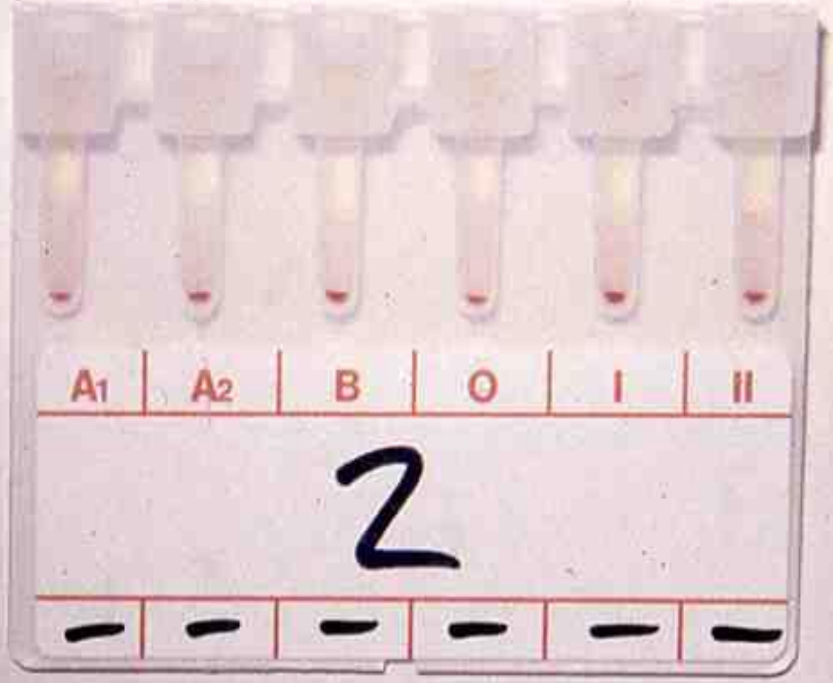
Anti-B

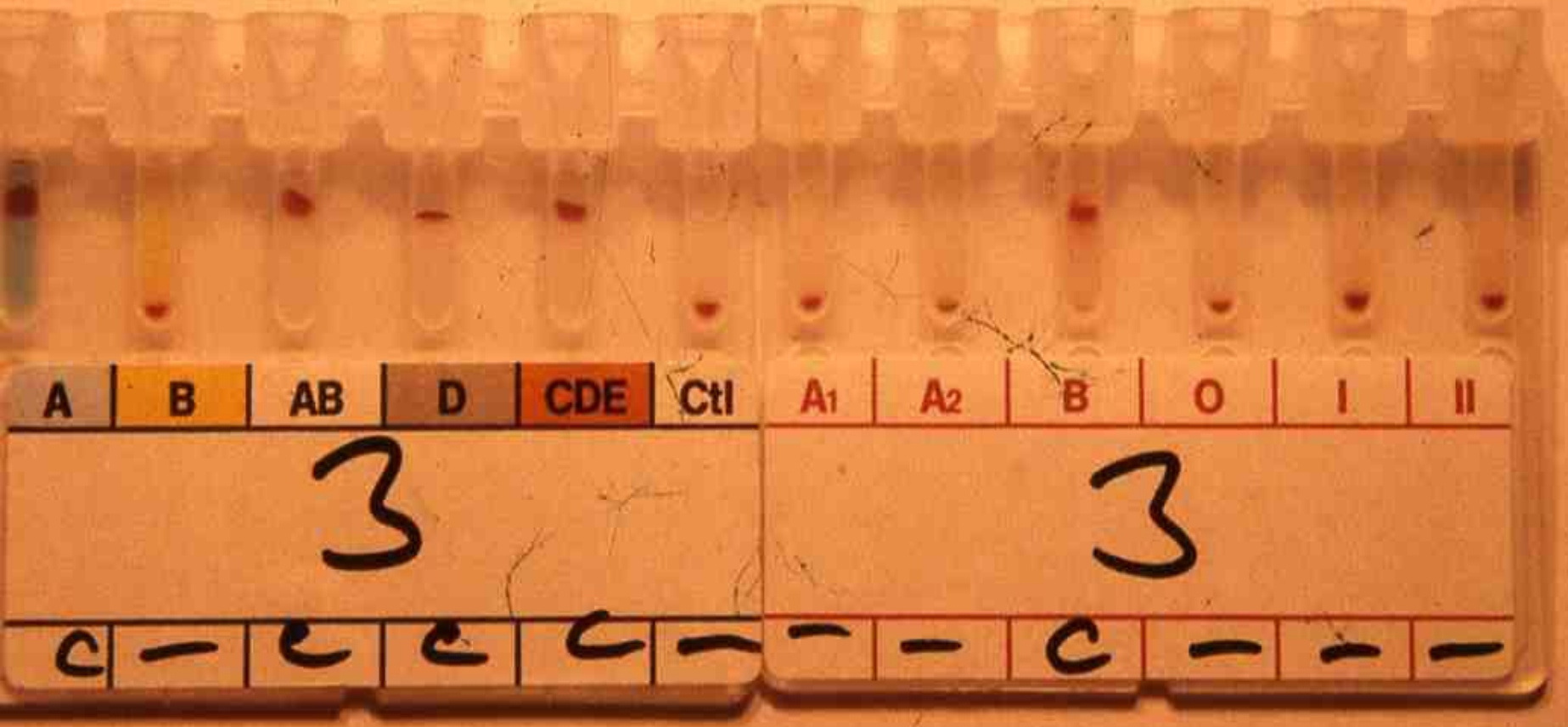
A/C

Rh




A
B
AB
D
CDE
Ctl
2
ABRhs
C
C
C
C
C
–


A1
A2
B
O
I
II
2
–
–
–
–
–
–



A POSITIVE

The Rh haplotypes in order of frequency (Fisher nomenclature) and the corresponding short notations

Fisher	Short notations	Approximate frequency (%)
CDe	R^1	41
Cde	r	39
cDE	R^2	14
cDe	R^O	3
C^wDe	R^{1w}	1
cdE	r”	1
Cde	r’	1
CDE	R^z	Rare
CdE	R^y	Rare

2. The specific tests performed on donated blood are listed below.

- Hepatitis B surface antigen (HBsAg).
- Hepatitis B core antibody (anti-HBc)
- Hepatitis C virus antibody (anti-HCV).
- HIV-1 and HIV-2 antibody (anti-HIV-1 and anti-HIV-2).
- HTLV-1 and HTLV-II antibody (anti-HTLV-I and anti-HTLV-II).
- Serologic test for syphilis, VDRL, RPR, TPHA.
- Nucleic acid amplification testing (NAT) for HIV-1 and HCV.
- NAT for WNV.
- G6PD test.
- Sickle cell test.

COMPATIBILITY TESTING & CROSS-MATCHING
Laboratory Tests

To be Completed Before Blood or Blood Products can be Transfused:

- Determination of the blood type with a crossmatch (between patients serum and donor red cells).
- Antibody screening on patients sera. (indirect comb's test)
- Directs comb's test on (donors red cells and patients red cells)
- Screening for antibodies that may produce adverse effects if transfused.
- Screening for possible infectious agents that could be transmitted with transfusion.

Antiglobulin test

- Its purpose is to detect antibodies to red cell surface constituents, either bound to the red cell surface or free in the serum.
- The antiglobulin test can be used in two ways. First, it can be used to detect antibody already on the patient's cells *in vivo*. Red cells are washed to remove the free IgG in the plasma, which would otherwise react with and neutralize the antiglobulin. After washing, anti-human globin is added and, if the red cells are coated with antibody, agglutination takes place. This is the *direct antiglobulin test*, used in the diagnosis of autoimmune haemolytic anaemia.

cont'd…

- Alternatively, the test can be used to detect the presence of antibody in serum, as in the cross-matching of blood for transfusion. In this case, serum from the patient who requires transfusion is incubated with donor red cells. Any antibody present in the recipient's serum that has specificity for antigens on the donor's cells will interact with those cells. After washing, addition of anti-human globulin will bring about red cell agglutination. This is *the indirect antiglobulin test.*

BLOOD TRANSFUSION
Type And Cross match

It determines compatibility between patient serum and donor red blood cells.

A full crossmatch procedure takes about 45 minutes to complete and cannot be shortened.
Units are refrigerated until used.
A unit of blood MUST be properly labeled and the label MUST be checked before use.

Compatibility

The purpose of cross-matching blood before transfusion is to ensure that there is no antibody present in the recipient's plasma that will react with any antigen on the donor's cells. The basic technique for detecting such antibodies relies on their ability to agglutinate red cells that bear the appropriate antigen.

BLOOD TRANSFUSION
Mandatory Tests on All Units of Blood

ABO group and Rh type

Screening for blood-group antibodies

Serologic test for syphilis

Serologic tests for human retroviruses including:

- HIV-1 antibody
- HIV-2 antibody
- HIV p24 antigen
- HTLV I antibodies

Serologic tests for hepatitis including:

- Hepatitis B core antibody (HBcAb)
- Hepatitis B surface antigen (HBsAg)
- Hepatitis C antibody

BLOOD TRANSFUSION

Type And Crossmatch (continue)

Every unit cross matched is removed from the general inventory and reserved for the patient for 72 hours. Units which are crossmatched unnecessarily will deplete Blood Bank inventories and can result in blood shortages.

Blood shortages can result in cancellation of elective surgical procedures.

Blood will ordinarily not be released for transfusion until compatibility testing is completed.

BLOOD TRANSFUSION
Type And Crossmatch (continue)

However, under emergency conditions, blood products may be released without a crosshatch if the patient is in danger of dying if transfusion is delayed.

In such cases, if the patient's blood type is not known, then group O Rh negative (O Neg) blood can be released without compatibility testing.

In cases in which the patient's blood type is reliably known, then type-specific blood or RBCs of the same ABO and Rh group may be released.

Haemolytic disease of the newborn

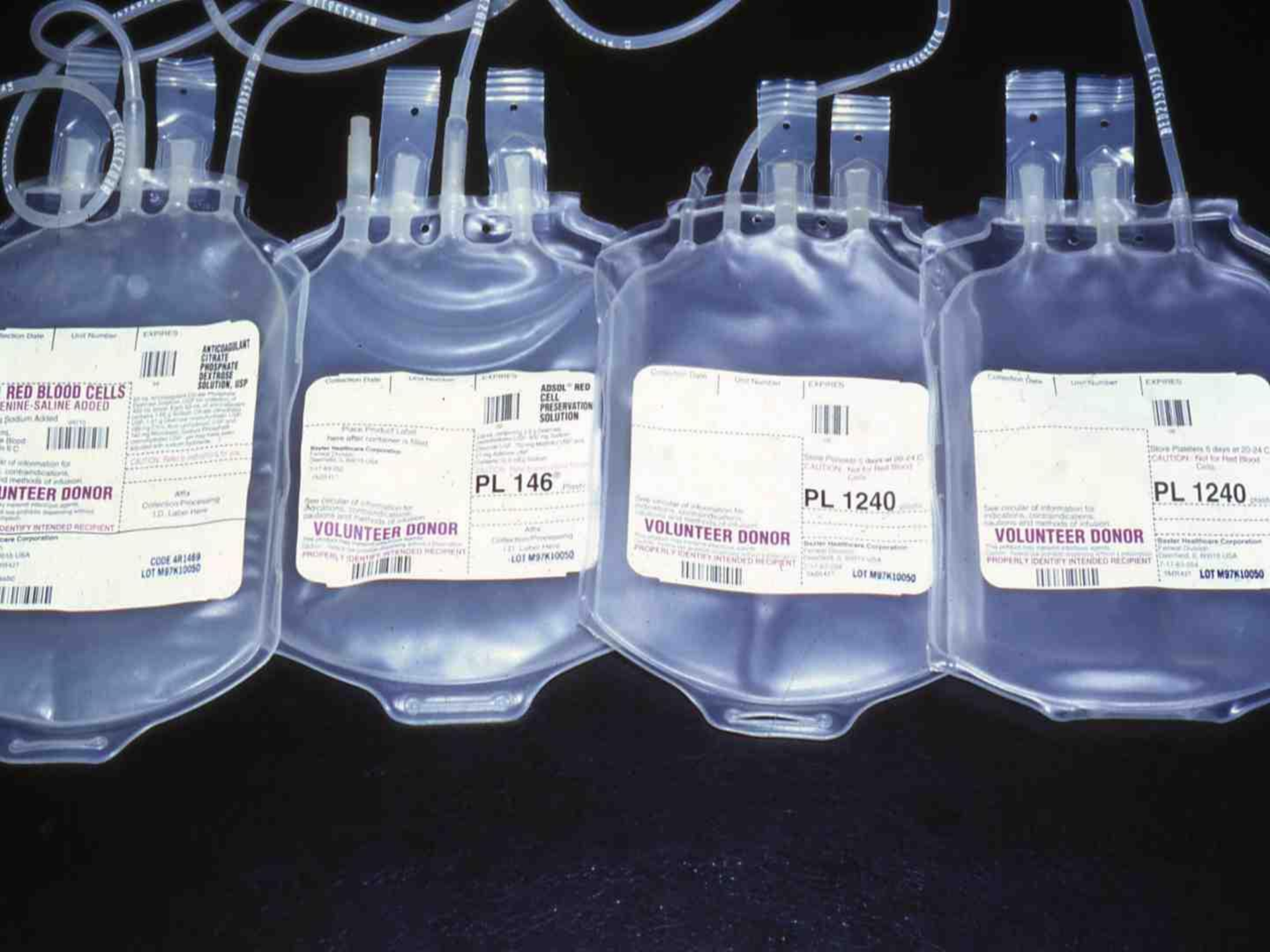
- Haemolytic disease of the newborn (HDN) is a major example of the clinical significance of blood groups, and arises as a consequence of fetus and mother having different blood group antigens. Following the passage of fetal red cells across the placenta, there is immunization of the mother to fetal blood group antigens that she does not possess.
- The IgG antibodies produced are subsequently transferred back across the placenta, and react with the fetal red cells causing their destruction.

cont'd…

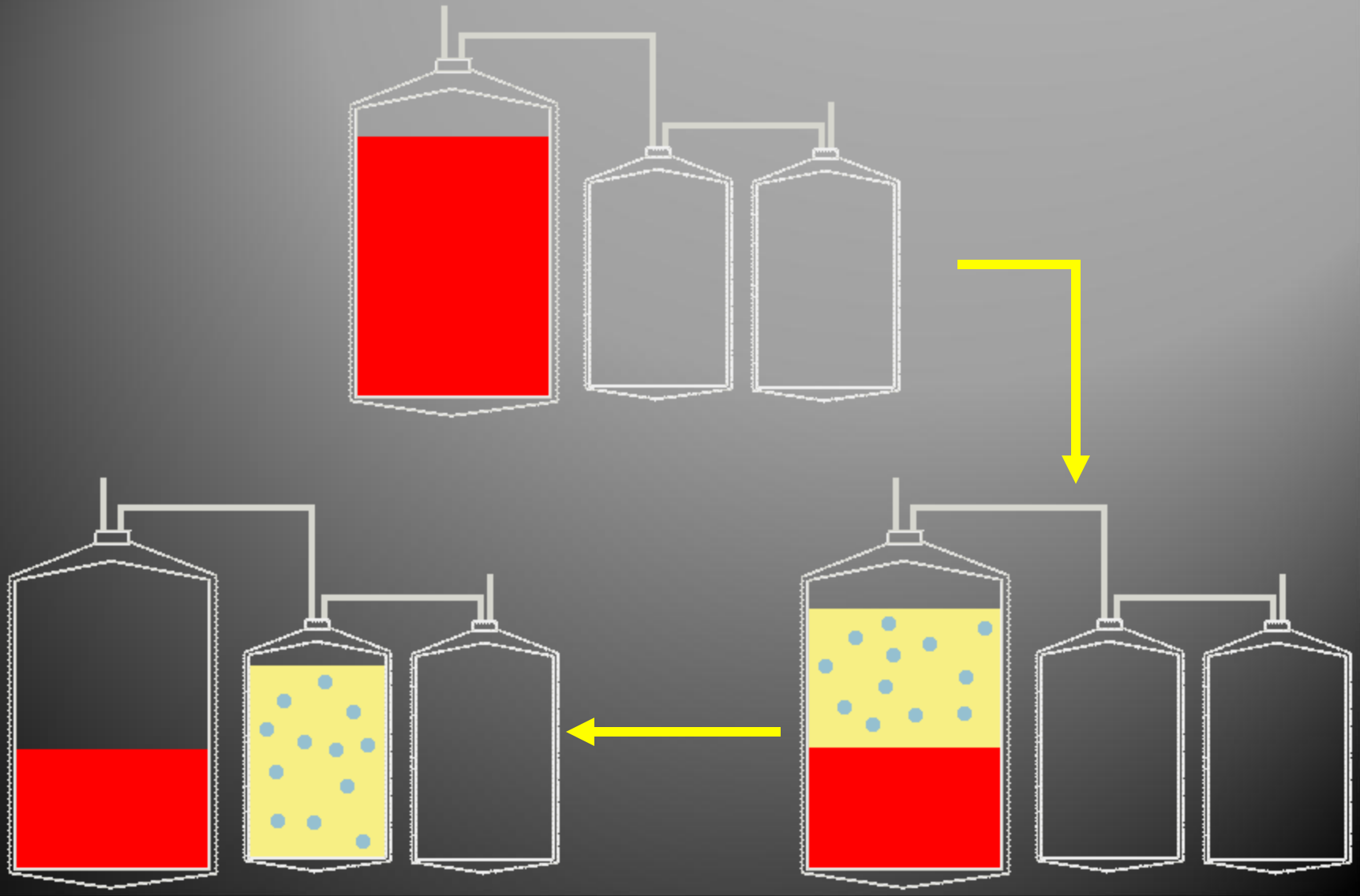
- Introduction of treatment by exchange transfusion.
- Approximately 60% of affected infants require an exchange transfusion.
- Prophylactic anti-D immunoglobulin injections were routinely introduced for RhD-negative mothers in the hours immediately following labour, to prevent active immunization due to fetal RhD exposure.

BLOOD COMPONENTS

PREPARATION

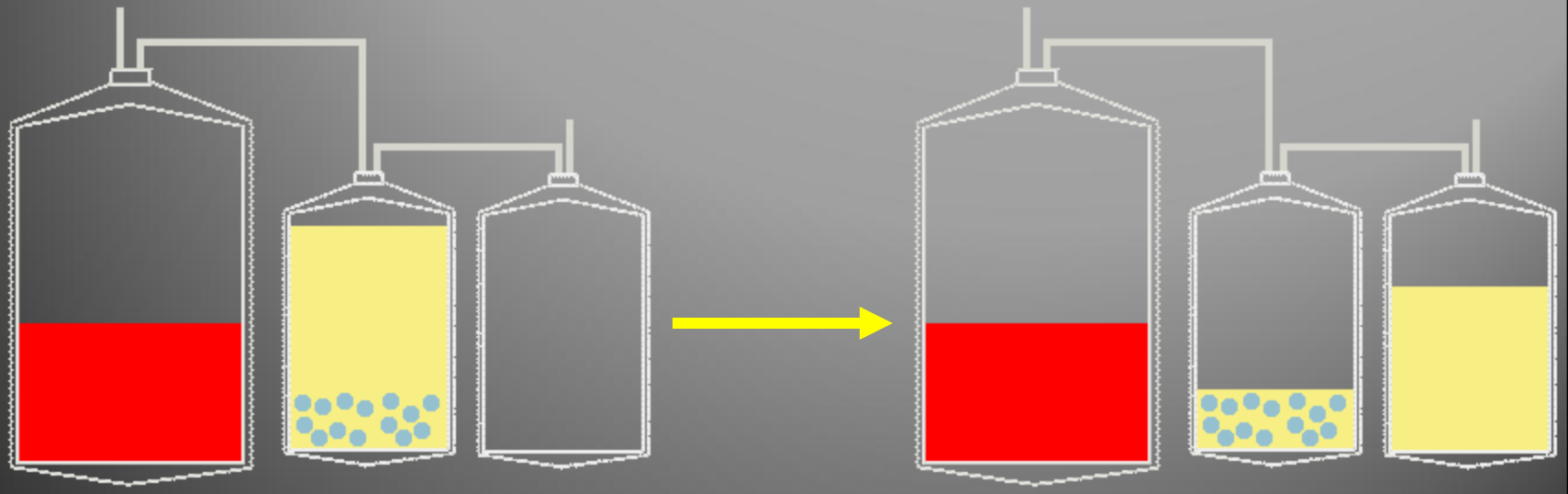

RED BLOOD CELLS
ENINE-SALINE ADDED
UNTEER DONOR
ANTICOAGULANT CITRATE PHOSPHATE DEXTROSE SOLUTION, USP
CODE 4R1469
LOT M87K10050
ADSOL® RED CELL PRESERVATION SOLUTION
PL 146
VOLUNTEER DONOR
PROPERLY IDENTIFY INTENDED RECIPIENT
LOT M97K10050
PL 1240
VOLUNTEER DONOR
LOT M87K10050
PL 1240
VOLUNTEER DONOR
PROPERLY IDENTIFY INTENDED RECIPIENT
LOT M97K10050

BLOOD COMPONENTS PREPARATION



BLOOD COMPONENTS PREPARATION

(Cont…)




K.S.H.
A
RH. POS.
K.S.H.
B
RH. POS.
K.S.H.
AB
K.S.H.
O
RH. POS.
K.S.H.
O
RH. NEG.

What types of tests are performed on donated blood?

- After blood is drawn, it is tested for ABO group (blood type) and RH type (positive or negative), as well as for any unexpected red blood cell antibodies that may cause problems for the recipient. Screening tests performed are listed below:

* Hepatitis B surface antigen (HbsAg).
* Hepatitis B core antibody (anti-HBc).
* Hepatitis C virus antibody (anti-HCV)

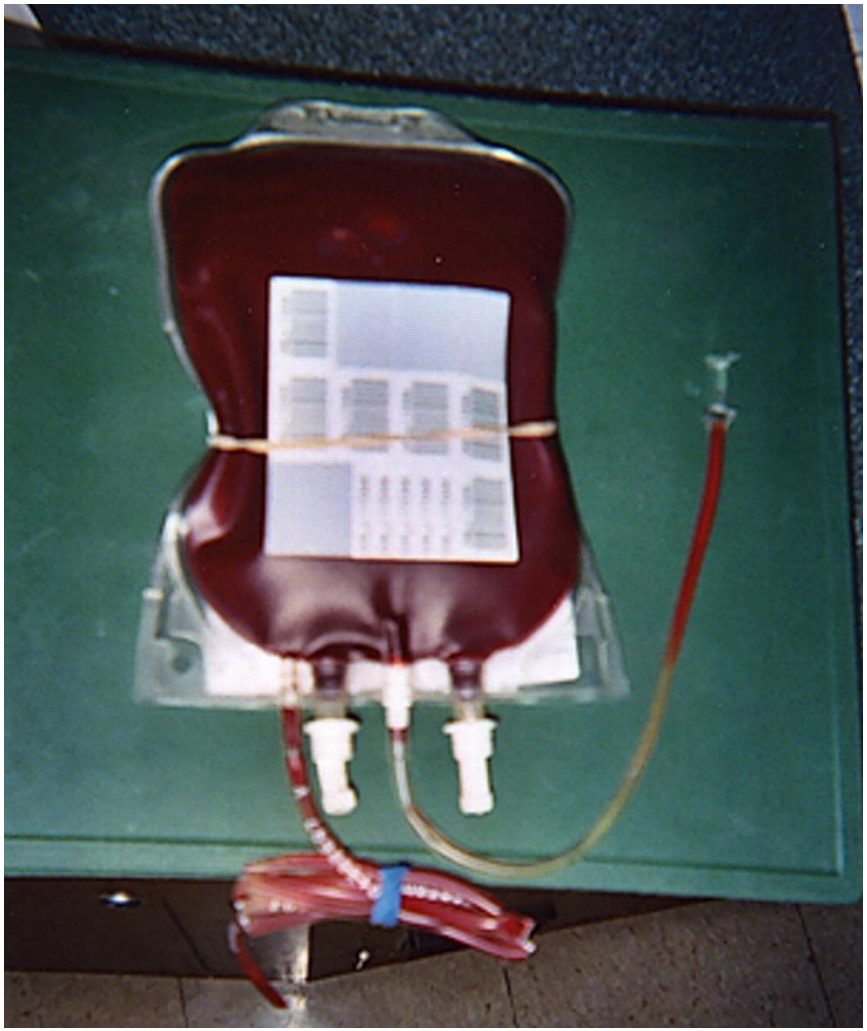
9. What types of tests are performed on donated blood? (continue)

* HIV-1 and HIV-2 antibody (anti-HIV-1 and anti-HIV-2)
* HIV p24 antigen
* HTLV-I and HTLV-II antibody (anti-HTLV-I and anti-HTLV-II)
* Serologic test for syphilis (VDR, RPR, TPHA).
* Nucleic Acid amplification Testing (NAT)
* Tests for malaria
* Sickle cell test
* G6PD test.


Speed rpm
Temperature °C
Brake
Time min
START
Imbalance


PL 1240

Packed red cells may contain enough leukocytes and platelets to result in alloimmunization




PART/PACKED CELLS
ANTICOAGULANT CITRATE PHOSPHATE
TERUMO
K.K.U.H.
B RH.
UNIT NO. F615
B RH. POS.
F615
PART/PACKED CELLS
DEXTROSE ADENINE
F600
K.K.U.H.
O RH. POS.
UNIT NO. F600
O RH. POS.
CONTINENTAL MEDICAL GROUP
Continental Blood Components
Continental Laboratories

How is blood stored and used?

Each unit of whole blood normally is separated into several components. Red blood cells may be stored under refrigeration for a maximum of 42 days, or they may be frozen for up to 10 years. Red cells carry oxygen and are used to treat anaemia.

Platelets are important in the control of bleeding and are generally used in patients with leukaemia and other forms of cancer. Platelets are stored at room temperature with continuous agitation and may be kept for a maximum of five days.

Fresh frozen plasma, used to control bleeding due to low levels of some clotting factors, is kept in a frozen state (-70^{o}C) for usually up to one year.

How is blood stored and used? (Continued)

Cryoprecipitate AHF, which contains only a few specific clotting factors, is made from fresh frozen plasma and may be stored frozen for up to one year. Granulocytes are sometimes used to fight infections, although their efficacy is not well established. They must be transfused within 24 hours of donation.

Other products manufactured from blood include albumin, Immune globulin, specific immune globulins, and clotting factor concentrates.
Commercial manufactures commonly produce these blood products.


O+POS
O+POS
AB+POS
AB+POS
O+POS
O+POS
O+POS
O+POS
A+POS
A+POS
A+POS
A+POS
B+POS
B+POS
B+POS
A+POS
BLOOD NO
READY FO
ISSUING
B-NEG
AB+POS
A+POS.
A+Pos

Platelet blood components may be stored for 5 days at room temperature without loss of function or viability


PLATELET CONC.
TERUFLEX
TERUMO TRANSF
STERILE, NON-PYROGENIC
DO NOT VENT
F544
A+os
18-4-05
CAPACITY
300 ml
TERUMO CORPORATION


FISHER
PLATELET MIXER
MODEL 348
ON
OFF


TERUFLEX T-300
CODE:
TERUMO TRANS
STERILE, NON-PYROGENIC
F518
DO NOT
BLOOD GROUP
Rh Type
CAPACITY:
300 ml
83-84C05-FC1
Lot No. (Mfg. Date)
Manufactured by:
TERUMO CORPORATION
Tokyo, Japan

Complications of Blood Transfusion

Immediate Transfusion Reactions

- **Hemolytic Reactions**
- **Allergic Reactions**
- **Febrile Reactions**
- **Transfusion related acute lung injury (TRALI)**
- **Bacterial Contamination**
- **Circulatory Overload**
- **Citrate toxicity**
- **Air embolism**
- **Alloimmunization:**
  - **RBCs**
  - **Platelets**

Complications of Blood Transfusion

Delayed Transfusion Reactions

- **Graft Versus Host Disease (GVHD)**
- **Transfusion-associated graft versus host disease (TAGVHD)**
- **Post-transfusion purpura**
- **Haemosiderosis**
- **H.D.N.**

BLOOD TRANSFUSION

Delayed Transfusion Reactions (Cont…)

Transmitted Diseases

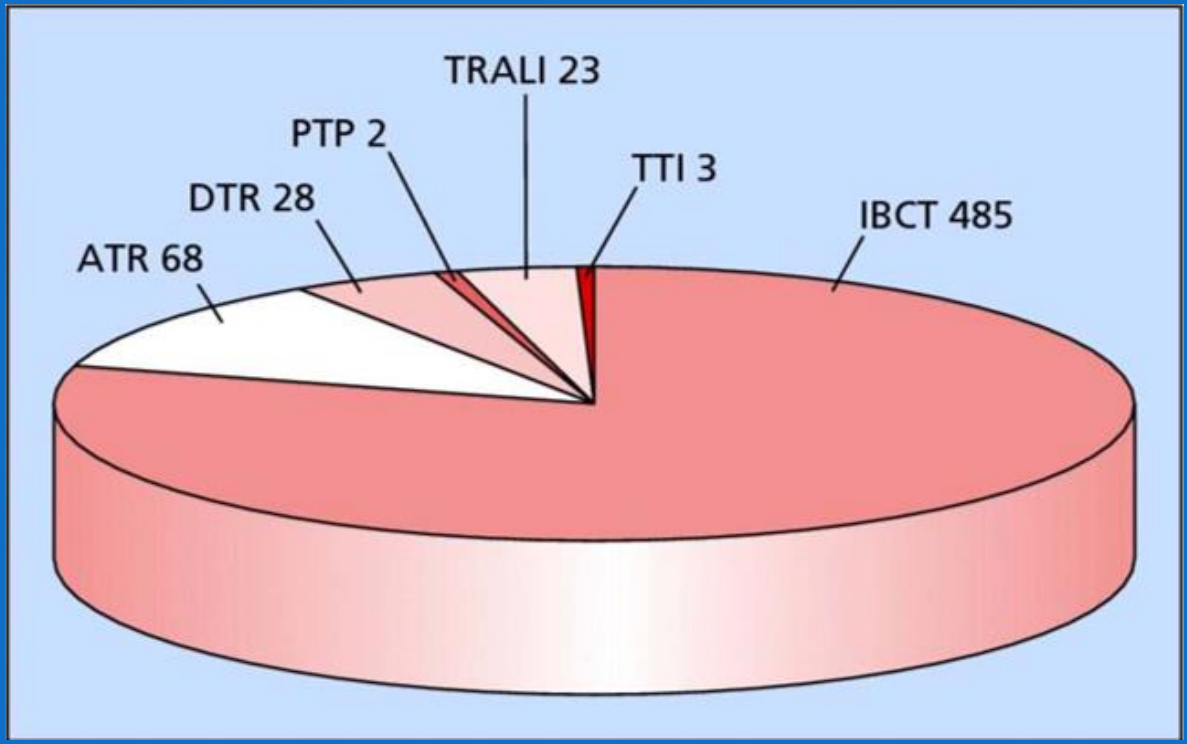
- **Hepatitis B**
- **Hepatitis C**
- **Human Immunodeficiency Virus (HIV)**
- **Human T-lymphocytotrophic Virus (HTLV-1)**
- **Cytomegalovirus (CMV)**
- **Kaposi's sarcoma and human herpes virus-8 (KS & HHV-8)**
- **Malaria**
- **Leishmaniasis**
- **Others:**
  - **Babesiosis.**
  - **Lyme disease.**
  - **Chagas' disease**
  - **Creutzfeldt-Jakob Disease (CJD)**
  - **Toxoplasmosis**

Signs and Symptoms of Blood Loss

Volume Lost		
mL	**% of Total Blood Volume**	**Clinical Signs**
500	10	None; occasionally vasovagal syncope in blood donors.
1000	20	At rest there may be no clinical evidence of volume loss; a slight postural drop in BP may be seen; tachycardia with exercise.
1500	30	Resting supine blood pressure and pulse may be normal; neck veins flat when supine; postural hypotension
2000	40	Central venous pressure, cardiac output, systolic blood pressure below normal even when supine and at rest; air hunger, cold clammy skin; tachycardia.
2500	50	Signs of shock, tachycardia, hypotension, oliguria, drowsiness, or coma.

Massive transfusion

- Patients with acute haemorrhage (i.e. loss of red cells and plasma) may need to be transfused with large quantities of packed red cells.
- Massive transfusion has been defined as the replacement of one blood volume over 24 hours, or as the replacement of 50% of circulating volume in 3 hours.
- With the transfusion of many units of packed red cells, the patient may become deficient in key plasma components such as clotting factors and may also become thrombocytopenic (even in the absence of DIC).
- The administration of one unit of FFP per unit of red cells may be effective in replacing clotting factors.
- Fibrinogen and platelets should also be replaced, with 2



This chart is showing hazards of transfusion in the UK from 1996-2010 as reported to the SHOT Committee.

Notes: TRALI - transfusion-associated acute lung injury; TTI - transfusion-transmitted infection; ATR - acute transfusion reaction; DTR - delayed transfusion reaction; PTP - post-transfusion purpura; IBCT - incorrect blood component transfused.

Source: UK SHOT Committee report 2010.

SHOT: Serious Hazards of Transfusion Committee

Investigation of a Haemolytic Transfusion Reaction

Evidence of Haemolysis

Examine patient's plasma and urine for haemoglobin and its derivaties.

Blood film may show spherocytosis

Evidence of incompatibility

- **Clerical checks. An identification error will indicate the type incompatibility.**
- **If no evidence of clerical error, proceed as follows:**

  Repeat ABO and Rh D groups of patient and donor unit and screen for antibodies.

  Use patient's pre-and post-transfusion samples

  Repeat compatibility tests, using patient's pre-and post – transfusion serum

  Direct antiglobulin test on post-transfusion red cells may indicate antibody and/or complement

Evidence of bacterial infection of donor blood

Gram stain and culture donor blood.

If intravascular hemolytic reaction is confirmed.

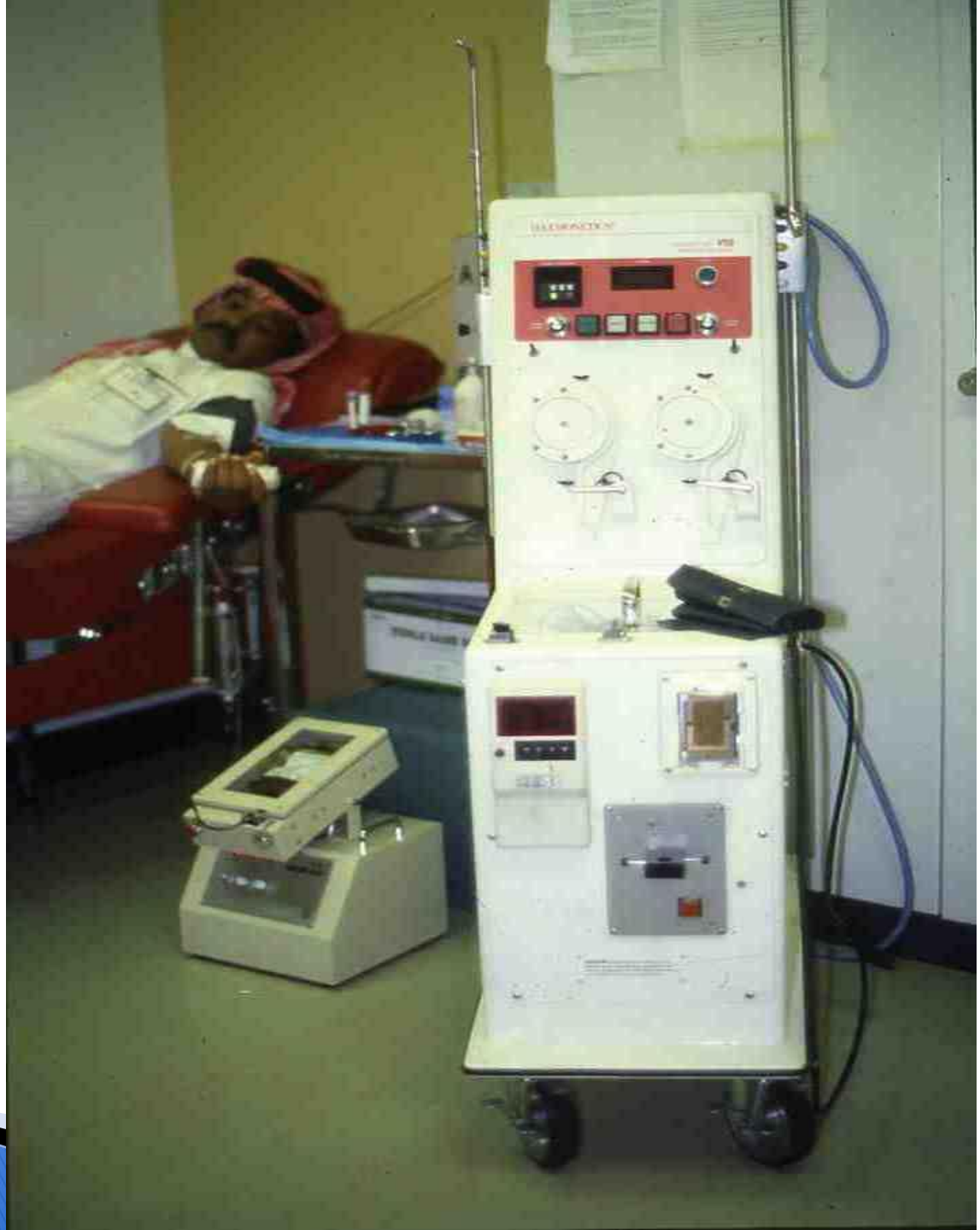
1. Monitor renal status (BUN, creatinine).
2. Initiate a diuresis.
3. Analyze urine for hemoglobinuria.
4. Monitor coagulation status (prothrombin time, partial thromboplastin time, fibrinogen, platelet count).
5. Monitor for signs of haemolysis (lactate dehydrogenase, bilirubin, haptoglobin, plasma hemoglobin).
6.. Repeat compatibility testing (crossmatch).
7. If sepsis is suspected, culture unit and patient, and treat as appropriate.

What is apheresis?

Apheresis, an increasingly common procedure, is the process of removing a specific component of the blood, such as platelets, and returning the remaining components, such as red blood cells and plasma, to the donor. This process allows more of one particular part of the blood to be collected than could be separated from a unit of whole blood. Apheresis is also performed to collect red blood cells, plasma (liquid part of the blood), and granulocytes (white blood cells).

What is apheresis? (continued)

The apheresis donation procedure takes longer than that for whole blood donation. A whole blood donation takes about 10 to 20 minutes to collect the blood, while an apheresis donation may take about one to two hours.



If an acute transfusion reaction occurs:

* Stop blood component transfusion immediately.
* Verify the correct unit was given to the correct patient.
* Maintain IV access and ensure adequate urine output with an appropriate crystalloid or colloid solution.
* Maintain blood pressure, pulse.
* Maintain adequate ventilation.
* Notify attending physician and blood bank.
* Obtain blood/urine for transfusion reaction workup.
* Send blood bag and administration set to blood transfusion service immediately.

Blood bank performs workup of suspected transfusion reaction as follows:

A. Check paper work to ensure correct blood component was transfused to the right patient.
B. Evaluate plasma for hemoglobinemia.
C. Perform direct antiglobulin test.
D. Repeat other serologic testing as needed (ABO, Rh).

THANK YOU